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(54) Title: EXPANDABLE TUBULAR

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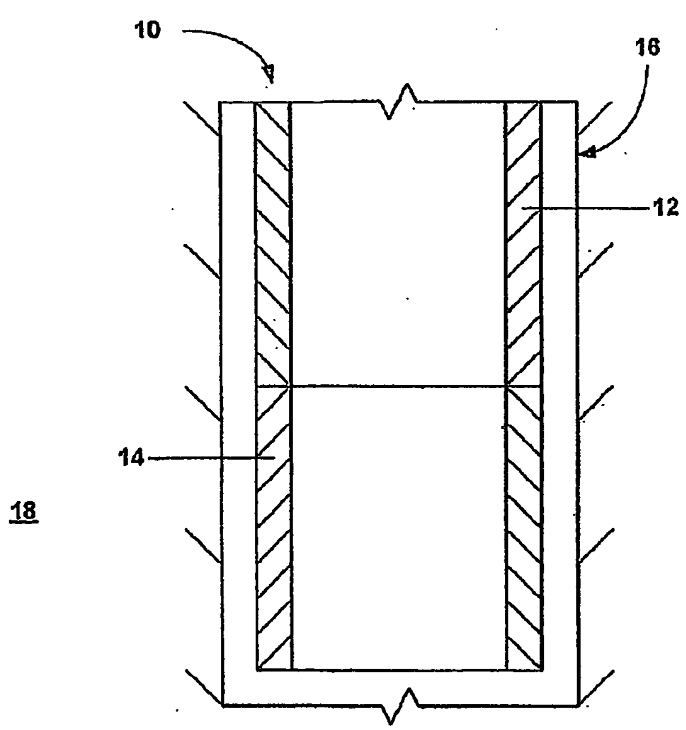

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EXPANDABLE TUBULAR

Cross Reference To Related Applications

[001] This application claims the benefit of the filing dates of: 1) U.S. provisional patent application serial number 60/585,370, attorney docket number 25791.299, filed on July 2, 2004, and 2) U.S. provisional patent application serial number 60/495,056, attorney docket number 25791.301, filed on August 14, 2003, the disclosures of which are incorporated herein by reference.

[002] This application is related to the following co-pending applications: (1) U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, which claims priority from provisional application 60/121,702, filed on 2/25/99, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (4) U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (5) U.S. patent application serial no. 10/169,434, attorney docket no. 25791.10.04, filed on 7/1/02, which claims priority from provisional application 60/183,546, filed on 2/18/00, (6) U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (7) U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (8) U.S. patent number 6,575,240, which was filed as patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, which claims priority from provisional application 60/121,907, filed on 2/26/99, (9) U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (10) U.S. patent application serial no. 09/981,916, attorney docket no. 25791.18, filed on 10/18/01 as a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (11) U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (12) U.S. patent application serial no. 10/030,593, attorney docket no. 25791.25.08, filed on

1/8/02, which claims priority from provisional application 60/146,203, filed on 7/29/99, (13) U.S. provisional patent application serial no. 60/143,039, attorney docket no. 25791.26, filed on 7/9/99, (14) U.S. patent application serial no. 10/111,982, attorney docket no. 25791.27.08, filed on 4/30/02, which claims priority from provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (15) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (16) U.S. provisional patent application serial no. 60/438,828, attorney docket no. 25791.31, filed on 1/9/03, (17) U.S. patent number 6,564,875, which was filed as application serial no. 09/679,907, attorney docket no. 25791.34.02, on 10/5/00, which claims priority from provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (18) U.S. patent application serial no. 10/089,419, filed on 3/27/02, attorney docket no. 25791.36.03, which claims priority from provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (19) U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (20) U.S. patent application serial no. 10/303,992, filed on 11/22/02, attorney docket no. 25791.38.07, which claims priority from provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (21) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (22) U.S. provisional patent application serial no. 60/455,051, attorney docket no. 25791.40, filed on 3/14/03, (23) PCT application US02/2477, filed on 6/26/02, attorney docket no. 25791.44.02, which claims priority from U.S. provisional patent application serial no. 60/303,711, attorney docket no. 25791.44, filed on 7/6/01, (24) U.S. patent application serial no. 10/311,412, filed on 12/12/02, attorney docket no. 25791.45.07, which claims priority from provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (25) U.S. patent application serial no. 10/, filed on 12/18/02, attorney docket no. 25791.46.07, which claims priority from provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (26) U.S. patent application serial no. 10/322,947, filed on 1/22/03, attorney docket no. 25791.47.03, which claims priority from provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (27) U.S. patent application serial no. 10/406,648, filed on 3/31/03, attorney docket no. 25791.48.06, which claims priority from provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (28) PCT application US02/04353, filed on 2/14/02, attorney docket no. 25791.50.02, which claims priority from U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001, (29) U.S. patent application serial no. 10/465,835, filed on 6/13/03, attorney docket no. 25791.51.06, which claims priority from provisional patent

application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001, (30) U.S. patent application serial no. 10/465,831, filed on 6/13/03, attorney docket no. 25791.52.06, which claims priority from U.S. provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001, (31) U.S. provisional patent application serial no. 60/452,303, filed on 3/5/03, attorney docket no. 25791.53, (32) U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (33) U.S. patent number 6,561,227, which was filed as patent application serial number 09/852,026 , filed on 5/9/01, attorney docket no. 25791.56, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (34) U.S. patent application serial number 09/852,027, filed on 5/9/01, attorney docket no. 25791.57, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (35) PCT Application US02/25608, attorney docket no. 25791.58.02, filed on 8/13/02, which claims priority from provisional application 60/318,021, filed on 9/7/01, attorney docket no. 25791.58, (36) PCT Application US02/24399, attorney docket no. 25791.59.02, filed on 8/1/02, which claims priority from U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001, (37) PCT Application US02/29856, attorney docket no. 25791.60.02, filed on 9/19/02, which claims priority from U.S. provisional patent application serial no. 60/326,886, attorney docket no. 25791.60, filed on 10/3/2001, (38) PCT Application US02/20256, attorney docket no. 25791.61.02, filed on 6/26/02, which claims priority from U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001, (39) U.S. patent application serial no. 09/962,469, filed on 9/25/01, attorney docket no. 25791.62, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (40) U.S. patent application serial no. 09/962,470, filed on 9/25/01, attorney docket no. 25791.63, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (41) U.S. patent application serial no. 09/962,471, filed on 9/25/01, attorney docket no. 25791.64, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application

60/124,042, filed on 3/11/99, (42) U.S. patent application serial no. 09/962,467, filed on 9/25/01, attorney docket no. 25791.65, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (43) U.S. patent application serial no. 09/962,468, filed on 9/25/01, attorney docket no. 25791.66, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (44) PCT application US 02/25727, filed on 8/14/02, attorney docket no. 25791.67.03, which claims priority from U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001, and U.S. provisional patent application serial no. 60/318,386, attorney docket no. 25791.67.02, filed on 9/10/2001, (45) PCT application US 02/39425, filed on 12/10/02, attorney docket no. 25791.68.02, which claims priority from U.S. provisional patent application serial no. 60/343,674 , attorney docket no. 25791.68, filed on 12/27/2001, (46) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (47) U.S. utility patent application serial no. 10/516,467, attorney docket no. 25791.70, filed on 12/10/01, which is a continuation application of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (48) PCT application US 03/00609, filed on 1/9/03, attorney docket no. 25791.71.02, which claims priority from U.S. provisional patent application serial no. 60/357,372 , attorney docket no. 25791.71, filed on 2/15/02, (49) U.S. patent application serial no. 10/074,703, attorney docket no. 25791.74, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (50) U.S. patent application serial no. 10/074,244, attorney docket no. 25791.75, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (51) U.S. patent application serial no. 10/076,660, attorney docket no. 25791.76, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application

60/121,841, filed on 2/26/99, (52) U.S. patent application serial no. 10/076,661, attorney docket no. 25791.77, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (53) U.S. patent application serial no. 10/076,659, attorney docket no. 25791.78, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (54) U.S. patent application serial no. 10/078,928, attorney docket no. 25791.79, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (55) U.S. patent application serial no. 10/078,922, attorney docket no. 25791.80, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (56) U.S. patent application serial no. 10/078,921, attorney docket no. 25791.81, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (57) U.S. patent application serial no. 10/261,928, attorney docket no. 25791.82, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (58) U.S. patent application serial no. 10/079,276 , attorney docket no. 25791.83, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (59) U.S. patent application serial no. 10/262,009, attorney docket no. 25791.84, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (60) U.S. patent application serial no. 10/092,481, attorney docket no. 25791.85, filed on 3/7/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (61) U.S. patent application serial no. 10/261,926, attorney docket no. 25791.86, filed on 10/1/02, which is a divisional of U.S.

patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (62) PCT application US 02/36157, filed on 11/12/02, attorney docket no. 25791.87.02, which claims priority from U.S. provisional patent application serial no. 60/338,996, attorney docket no. 25791.87, filed on 11/12/01, (63) PCT application US 02/36267, filed on 11/12/02, attorney docket no. 25791.88.02, which claims priority from U.S. provisional patent application serial no. 60/339,013, attorney docket no. 25791.88, filed on 11/12/01, (64) PCT application US 03/11765, filed on 4/16/03, attorney docket no. 25791.89.02, which claims priority from U.S. provisional patent application serial no. 60/383,917, attorney docket no. 25791.89, filed on 5/29/02, (65) PCT application US 03/15020, filed on 5/12/03, attorney docket no. 25791.90.02, which claims priority from U.S. provisional patent application serial no. 60/391,703, attorney docket no. 25791.90, filed on 6/26/02, (66) PCT application US 02/39418, filed on 12/10/02, attorney docket no. 25791.92.02, which claims priority from U.S. provisional patent application serial no. 60/346,309, attorney docket no. 25791.92, filed on 1/7/02, (67) PCT application US 03/06544, filed on 3/4/03, attorney docket no. 25791.93.02, which claims priority from U.S. provisional patent application serial no. 60/372,048, attorney docket no. 25791.93, filed on 4/12/02, (68) U.S. patent application serial no. 10/331,718, attorney docket no. 25791.94, filed on 12/30/02, which is a divisional U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (69) PCT application US 03/04837, filed on 2/29/03, attorney docket no. 25791.95.02, which claims priority from U.S. provisional patent application serial no. 60/363,829, attorney docket no. 25791.95, filed on 3/13/02, (70) U.S. patent application serial no. 10/261,927, attorney docket no. 25791.97, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (71) U.S. patent application serial no. 10/262,008, attorney docket no. 25791.98, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (72) U.S. patent application serial no. 10/261,925, attorney docket no. 25791.99, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (73) U.S. patent application serial no. 10/199,524, attorney docket no. 25791.100, filed on 7/19/02, which is a continuation of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application

serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (74) PCT application US 03/10144, filed on 3/28/03, attorney docket no. 25791.101.02, which claims priority from U.S. provisional patent application serial no. 60/372,632, attorney docket no. 25791.101, filed on 4/15/02, (75) U.S. provisional patent application serial no. 60/412,542, attorney docket no. 25791.102, filed on 9/20/02, (76) PCT application US 03/14153, filed on 5/6/03, attorney docket no. 25791.104.02, which claims priority from U.S. provisional patent application serial no. 60/380,147, attorney docket no. 25791.104, filed on 5/6/02, (77) PCT application US 03/19993, filed on 6/24/03, attorney docket no. 25791.106.02, which claims priority from U.S. provisional patent application serial no. 60/397,284, attorney docket no. 25791.106, filed on 7/19/02, (78) PCT application US 03/13787, filed on 5/5/03, attorney docket no. 25791.107.02, which claims priority from U.S. provisional patent application serial no. 60/387,486 , attorney docket no. 25791.107, filed on 6/10/02, (79) PCT application US 03/18530, filed on 6/11/03, attorney docket no. 25791.108.02, which claims priority from U.S. provisional patent application serial no. 60/387,961, attorney docket no. 25791.108, filed on 6/12/02, (80) PCT application US 03/20694, filed on 7/1/03, attorney docket no. 25791.110.02, which claims priority from U.S. provisional patent application serial no. 60/398,061, attorney docket no. 25791.110, filed on 7/24/02, (81) PCT application US 03/20870, filed on 7/2/03, attorney docket no. 25791.111.02, which claims priority from U.S. provisional patent application serial no. 60/399,240, attorney docket no. 25791.111, filed on 7/29/02, (82) U.S. provisional patent application serial no. 60/412,487, attorney docket no. 25791.112, filed on 9/20/02, (83) U.S. provisional patent application serial no. 60/412,488, attorney docket no. 25791.114, filed on 9/20/02, (84) U.S. patent application serial no. 10/280,356, attorney docket no. 25791.115, filed on 10/25/02, which is a continuation of U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (85) U.S. provisional patent application serial no. 60/412,177, attorney docket no. 25791.117, filed on 9/20/02, (86) U.S. provisional patent application serial no. 60/412,653, attorney docket no. 25791.118, filed on 9/20/02, (87) U.S. provisional patent application serial no. 60/405,610, attorney docket no. 25791.119, filed on 8/23/02, (88) U.S. provisional patent application serial no. 60/405,394, attorney docket no. 25791.120, filed on 8/23/02, (89) U.S. provisional patent application serial no. 60/412,544, attorney docket no. 25791.121, filed on 9/20/02, (90) PCT application US 03/24779, filed on 8/8/03, attorney docket no. 25791.125.02, which claims priority from U.S. provisional patent application serial no. 60/407,442, attorney docket no. 25791.125, filed on 8/30/02, (91) U.S.

provisional patent application serial no. 60/423,363, attorney docket no. 25791.126, filed on 12/10/02, (92) U.S. provisional patent application serial no. 60/412,196, attorney docket no. 25791.127, filed on 9/20/02, (93) U.S. provisional patent application serial no. 60/412,187, attorney docket no. 25791.128, filed on 9/20/02, (94) U.S. provisional patent application serial no. 60/412,371, attorney docket no. 25791.129, filed on 9/20/02, (95) U.S. patent application serial no. 10/382,325, attorney docket no. 25791.145, filed on 3/5/03, which is a continuation of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (96) U.S. patent application serial no. 10/624,842, attorney docket no. 25791.151, filed on 7/22/03, which is a divisional of U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (97) U.S. provisional patent application serial no. 60/431,184, attorney docket no. 25791.157, filed on 12/5/02, (98) U.S. provisional patent application serial no. 60/448,526, attorney docket no. 25791.185, filed on 2/18/03, (99) U.S. provisional patent application serial no. 60/461,539, attorney docket no. 25791.186, filed on 4/9/03, (100) U.S. provisional patent application serial no. 60/462,750, attorney docket no. 25791.193, filed on 4/14/03, (101) U.S. provisional patent application serial no. 60/436,106, attorney docket no. 25791.200, filed on 12/23/02, (102) U.S. provisional patent application serial no. 60/442,942, attorney docket no. 25791.213, filed on 1/27/03, (103) U.S. provisional patent application serial no. 60/442,938, attorney docket no. 25791.225, filed on 1/27/03, (104) U.S. provisional patent application serial no. 60/418,687, attorney docket no. 25791.228, filed on 4/18/03, (105) U.S. provisional patent application serial no. 60/454,896, attorney docket no. 25791.236, filed on 3/14/03, (106) U.S. provisional patent application serial no. 60/450,504, attorney docket no. 25791.238, filed on 2/26/03, (107) U.S. provisional patent application serial no. 60/451,152, attorney docket no. 25791.239, filed on 3/9/03, (108) U.S. provisional patent application serial no. 60/455,124, attorney docket no. 25791.241, filed on 3/17/03, (109) U.S. provisional patent application serial no. 60/453,678, attorney docket no. 25791.253, filed on 3/11/03, (110) U.S. patent application serial no. 10/421,682, attorney docket no. 25791.256, filed on 4/23/03, which is a continuation of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (111) U.S. provisional patent application serial no. 60/457,965, attorney docket no. 25791.260, filed on 3/27/03, (112) U.S. provisional patent application serial no. 60/455,718, attorney docket no. 25791.262, filed on 3/18/03, (113) U.S. patent number 6,550,821, which was filed as patent application serial no. 09/811,734, filed on 3/19/01, (114) U.S. patent application serial no. 10/436,467, attorney docket no. 25791.268, filed on 5/12/03, which is a continuation of U.S.

patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (115) U.S. provisional patent application serial no. 60/459,776, attorney docket no. 25791.270, filed on 4/2/03, (116) U.S. provisional patent application serial no. 60/461,094, attorney docket no. 25791.272, filed on 4/8/03, (117) U.S. provisional patent application serial no. 60/461,038, attorney docket no. 25791.273, filed on 4/7/03, (118) U.S. provisional patent application serial no. 60/463,586, attorney docket no. 25791.277, filed on 4/17/03, (119) U.S. provisional patent application serial no. 60/472,240, attorney docket no. 25791.286, filed on 5/20/03, (120) U.S. patent application serial no. 10/619,285, attorney docket no. 25791.292, filed on 7/14/03, which is a continuation-in-part of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (121) U.S. utility patent application serial no. 10/418,688, attorney docket no. 25791.257, which was filed on 4/18/03, as a division of U.S. utility patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (122) PCT patent application serial no. PCT/US04/06246, attorney docket no. 25791.238.02, filed on 2/26/2004, (123) PCT patent application serial number PCT/US04/08170, attorney docket number 25791.40.02, filed on 3/15/04, (124) PCT patent application serial number PCT/US04/08171, attorney docket number 25791.236.02, filed on 3/15/04, (125) PCT patent application serial number PCT/US04/08073, attorney docket number 25791.262.02, filed on 3/18/04, (126) PCT patent application serial number PCT/US04/07711, attorney docket number 25791.253.02, filed on 3/11/2004, (127) PCT patent application serial number PCT/US2004/009434, attorney docket number 25791.260.02, filed on 3/26/2004, (128) PCT patent application serial number PCT/US2004/010317, attorney docket number 25791.270.02, filed on 4/2/2004, (129) PCT patent application serial number PCT/US2004/010712, attorney docket number 25791.272.02, filed on 4/7/2004, (130) PCT patent application serial number PCT/US2004/010762, attorney docket number 25791.273.02, filed on 4/6/2004, (131) PCT patent application serial number PCT/2004/011973, attorney docket number 25791.277.02, filed on 4/15/2004, (132) U.S. provisional patent application serial number 60/495,056, attorney docket number 25791.301, filed on 8/14/2003, and (133) U.S. provisional patent application serial number 60/________, attorney docket number 25791.194, filed on 8/11/2004, the disclosures of which are incorporated herein by reference.

Background of the Invention

[003] This invention relates generally to oil and gas exploration, and in particular to forming and repairing wellbore casings to facilitate oil and gas exploration.

Summary Of The Invention

[004] According to one aspect of the present invention, a method of forming a tubular liner within a preexisting structure is provided that includes positioning a tubular assembly within the preexisting structure; and radially expanding and plastically deforming the tubular assembly within the preexisting structure, wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly.

[005] According to another aspect of the present invention, an expandable tubular member is provided that includes a steel alloy including: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr.

[006] According to another aspect of the present invention, an expandable tubular member is provided that includes a steel alloy including: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr.

[007] According to another aspect of the present invention, an expandable tubular member is provided that includes a steel alloy including: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr.

[008] According to another aspect of the present invention, an expandable tubular member is provided that includes a steel alloy including: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr.

[009] According to another aspect of the present invention, an expandable tubular member is provided, wherein the yield point of the expandable tubular member is at most about 46.9 ksi prior to a radial expansion and plastic deformation; and wherein the yield point of the expandable tubular member is at least about 65.9 ksi after the radial expansion and plastic deformation.

[0010] According to another aspect of the present invention, an expandable tubular member is provided, wherein a yield point of the expandable tubular member after a radial expansion and plastic deformation is at least about 40 % greater than the yield point of the expandable tubular member prior to the radial expansion and plastic deformation.

[0011] According to another aspect of the present invention, an expandable tubular member is provided, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.48.

[0012] According to another aspect of the present invention, an expandable tubular member is provided, wherein the yield point of the expandable tubular member is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the

expandable tubular member is at least about 74.4 ksi after the radial expansion and plastic deformation.

[0013] According to another aspect of the present invention, an expandable tubular member is provided, wherein the yield point of the expandable tubular member after a radial expansion and plastic deformation is at least about 28 % greater than the yield point of the expandable tubular member prior to the radial expansion and plastic deformation.

[0014] According to another aspect of the present invention, an expandable tubular member is provided, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.04.

[0015] According to another aspect of the present invention, an expandable tubular member is provided, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.92.

[0016] According to another aspect of the present invention, an expandable tubular member is provided, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.34.

[0017] According to another aspect of the present invention, an expandable tubular member is provided, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92.

[0018] According to another aspect of the present invention, an expandable tubular member is provided, wherein the yield point of the expandable tubular member, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi.

[0019] According to another aspect of the present invention, an expandable tubular member is provided, wherein the expandability coefficient of the expandable tubular member, prior to the radial expansion and plastic deformation, is greater than 0.12.

[0020] According to another aspect of the present invention, an expandable tubular member is provided, wherein the expandability coefficient of the expandable tubular member is greater than the expandability coefficient of another portion of the expandable tubular member.

[0021] According to another aspect of the present invention, an expandable tubular member is provided, wherein the tubular member has a higher ductility and a lower yield point prior to a radial expansion and plastic deformation than after the radial expansion and plastic deformation.

[0022] According to another aspect of the present invention, a method of radially expanding and plastically deforming a tubular assembly including a first tubular member coupled to a second tubular member is provided that includes radially expanding and plastically deforming the tubular assembly within a preexisting structure; and using less power to

radially expand each unit length of the first tubular member than to radially expand each unit length of the second tubular member.

[0023] According to another aspect of the present invention, a system for radially expanding and plastically deforming a tubular assembly including a first tubular member coupled to a second tubular member is provided that includes means for radially expanding the tubular assembly within a preexisting structure; and means for using less power to radially expand each unit length of the first tubular member than required to radially expand each unit length of the second tubular member.

[0024] According to another aspect of the present invention, a method of manufacturing a tubular member is provided that includes processing a tubular member until the tubular member is characterized by one or more intermediate characteristics; positioning the tubular member within a preexisting structure; and processing the tubular member within the preexisting structure until the tubular member is characterized one or more final characteristics.

[0025] According to another aspect of the present invention, an apparatus is provided that includes an expandable tubular assembly; and an expansion device coupled to the expandable tubular assembly; wherein a predetermined portion of the expandable tubular assembly has a lower yield point than another portion of the expandable tubular assembly.

[0026] According to another aspect of the present invention, an expandable tubular member is provided, wherein a yield point of the expandable tubular member after a radial expansion and plastic deformation is at least about 5.8 % greater than the yield point of the expandable tubular member prior to the radial expansion and plastic deformation.

[0027] According to another aspect of the present invention, a method of determining the expandability of a selected tubular member is provided that includes determining an anisotropy value for the selected tubular member, determining a strain hardening value for the selected tubular member; and multiplying the anisotropy value times the strain hardening value to generate an expandability value for the selected tubular member.

[0028] According to another aspect of the present invention, a method of radially expanding and plastically deforming tubular members is provided that includes selecting a tubular member; determining an anisotropy value for the selected tubular member; determining a strain hardening value for the selected tubular member; multiplying the anisotropy value times the strain hardening value to generate an expandability value for the selected tubular member; and if the anisotropy value is greater than 0.12, then radially expanding and plastically deforming the selected tubular member.

[0029] According to another aspect of the present invention, a radially expandable tubular member apparatus is provided that includes a first tubular member; a second tubular member engaged with the first tubular member forming a joint; and a sleeve overlapping and

coupling the first and second tubular members at the joint; wherein, prior to a radial expansion and plastic deformation of the apparatus, a predetermined portion of the apparatus has a lower yield point than another portion of the apparatus.

[0030] According to another aspect of the present invention, a radially expandable tubular member apparatus is provided that includes: a first tubular member; a second tubular member engaged with the first tubular member forming a joint; a sleeve overlapping and coupling the first and second tubular members at the joint; the sleeve having opposite tapered ends and a flange engaged in a recess formed in an adjacent tubular member; and one of the tapered ends being a surface formed on the flange; wherein, prior to a radial expansion and plastic deformation of the apparatus, a predetermined portion of the apparatus has a lower yield point than another portion of the apparatus.

[0031] According to another aspect of the present invention, a method of joining radially expandable tubular members is provided that includes: providing a first tubular member; engaging a second tubular member with the first tubular member to form a joint; providing a sleeve; mounting the sleeve for overlapping and coupling the first and second tubular members at the joint; wherein the first tubular member, the second tubular member, and the sleeve define a tubular assembly; and radially expanding and plastically deforming the tubular assembly; wherein, prior to the radial expansion and plastic deformation, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly.

[0032] According to another aspect of the present invention, a method of joining radially expandable tubular members is provided that includes providing a first tubular member; engaging a second tubular member with the first tubular member to form a joint; providing a sleeve having opposite tapered ends and a flange, one of the tapered ends being a surface formed on the flange; mounting the sleeve for overlapping and coupling the first and second tubular members at the joint, wherein the flange is engaged in a recess formed in an adjacent one of the tubular members; wherein the first tubular member, the second tubular member, and the sleeve define a tubular assembly; and radially expanding and plastically deforming the tubular assembly; wherein, prior to the radial expansion and plastic deformation, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly.

[0033] According to another aspect of the present invention, an expandable tubular assembly is provided that includes a first tubular member; a second tubular member coupled to the first tubular member; a first threaded connection for coupling a portion of the first and second tubular members; a second threaded connection spaced apart from the first threaded connection for coupling another portion of the first and second tubular members; a tubular sleeve coupled to and receiving end portions of the first and second tubular

members; and a sealing element positioned between the first and second spaced apart threaded connections for sealing an interface between the first and second tubular member; wherein the sealing element is positioned within an annulus defined between the first and second tubular members; and wherein, prior to a radial expansion and plastic deformation of the assembly, a predetermined portion of the assembly has a lower yield point than another portion of the apparatus.

[0034] According to another aspect of the present invention, a method of joining radially expandable tubular members is provided that includes: providing a first tubular member; providing a second tubular member; providing a sleeve; mounting the sleeve for overlapping and coupling the first and second tubular members; threadably coupling the first and second tubular members at a first location; threadably coupling the first and second tubular members at a second location spaced apart from the first location; sealing an interface between the first and second tubular members between the first and second locations using a compressible sealing element, wherein the first tubular member, second tubular member, sleeve, and the sealing element define a tubular assembly; and radially expanding and plastically deforming the tubular assembly; wherein, prior to the radial expansion and plastic deformation, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly.

[0035] According to another aspect of the present invention, an expandable tubular member is provided, wherein the carbon content of the tubular member is less than or equal to 0.12 percent; and wherein the carbon equivalent value for the tubular member is less than 0.21.

[0036] According to another aspect of the present invention, an expandable tubular member is provided, wherein the carbon content of the tubular member is greater than 0.12 percent; and wherein the carbon equivalent value for the tubular member is less than 0.36.

[0037] According to another aspect of the present invention, a method of selecting tubular members for radial expansion and plastic deformation is provided that includes selecting a tubular member from a collection of tubular member; determining a carbon content of the selected tubular member; determining a carbon equivalent value for the selected tubular member; and if the carbon content of the selected tubular member is less than or equal to 0.12 percent and the carbon equivalent value for the selected tubular member is less than 0.21, then determining that the selected tubular member is suitable for radial expansion and plastic deformation.

[0038] According to another aspect of the present invention, a method of selecting tubular members for radial expansion and plastic deformation is provided that includes selecting a tubular member from a collection of tubular member; determining a carbon content of the selected tubular member; determining a carbon equivalent value for the selected tubular member; and if the carbon content of the selected tubular member is greater than 0.12

percent and the carbon equivalent value for the selected tubular member is less than 0.36, then determining that the selected tubular member is suitable for radial expansion and plastic deformation.

[0039] According to another aspect of the present invention, an expandable tubular member is provided that includes a tubular body; wherein a yield point of an inner tubular portion of the tubular body is less than a yield point of an outer tubular portion of the tubular body.

[0040] According to another aspect of the present invention, a method of manufacturing an expandable tubular member has been provided that includes: providing a tubular member; heat treating the tubular member; and quenching the tubular member; wherein following the quenching, the tubular member comprises a microstructure comprising a hard phase structure and a soft phase structure.

[0041] According to another aspect of the present invention, a method for manufacturing an expandable tubular member has been provided that includes providing a material, heat treating the material, quenching the material, and cold working the material, whereby upon cold working, the yield strength of the material is increased.

[0042] According to another aspect of the present invention, a method for expanding an expandable tubular member has been provided that includes providing a tubular member, lubricating the tubular member, and expanding the tubular member.

[0043] According to another aspect of the present invention, a method for formability evaluation has been provided that includes providing a tubular member, measuring a plurality of stress and strain property parameters for the tubular member, measuring a Charpy V-notch impact value parameter for the tubular member, measuring a stress rupture parameter for the tubular member, measuring a strain hardening exponent parameter for the tubular member, measuring a plastic strain ratio parameter for the tubular member, comparing the parameters measured for first tubular member to a plurality of parameters measured for a second tubular member, and selecting the first or second tubular member to manufacture an expandable tubular member.

[0044] According to another aspect of the present invention, an expandable tubular member has been provided that includes a tensile strength in the range of 60 ksi to 120 ksi, a yield strength in the range of 40 ksi to 100 ksi, a yield strength to tensile strength ratio in the range of 50% to 85%, a minimum elongation of 35%, a minimum width reduction of 40%, a minimum thickness reduction of 30%, and a minimum anisotropy of 1.5.

[0045] According to another aspect of the present invention, a method for transforming the yield strength of an expandable tubular member has been provided that includes providing a manufactured tubular member, cold rolling the tubular member, inter-critical annealing the tubular member, expanding the tubular member, and heating the tubular member.

[0046] According to another aspect of the present invention, an expandable tubular member has been provided that includes a tensile strength in the range of 80 ksi to 100 ksi, a yield strength in the range of 60 ksi to 90 ksi, a maximum yield strength to tensile strength ratio of 85%, a minimum elongation of 22%, a minimum width reduction of 30%, a minimum thickness reduction of 35%, and a minimum anisotropy of 0.8.

[0047] According to another aspect of the present invention, an expandable tubular member has been provided that includes a tensile strength in the range of 60 ksi to 120 ksi, a yield strength in the range of 40 ksi to 100 ksi, a yield strength to tensile strength ratio in the range of 50% to 85%, a minimum elongation of 35%, a minimum width reduction of 40%, a minimum thickness reduction of 30%, and a minimum anisotropy of 1.5.

[0048] According to another aspect of the present invention, a method for transforming the yield strength of an expandable tubular member has been provided that includes providing a manufactured tubular member, inter-critical annealing the tubular member, expanding the tubular member, and heating the tubular member.

[0049] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 76 ksi, a tensile strength of approximately 82 ksi, and an elongation of approximately 32%.

[0050] According to another aspect of the present invention, an expandable tubular member has been provided that includes a surface, a self lubricating hard coating on the surface, and a self lubricating soft coating on the surface.

[0051] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength in the range of 40 ksi to 80 ksi, a maximum yield strength to tensile strength ratio of 0.5, a minimum elongation of 30%, a minimum width reduction of 45%, a minimum wall thickness reduction of 30%, and a minimum anisotropy of 1.5.

[0052] According to another aspect of the present invention, an expandable tubular member has been provided that includes a friction coefficient of 0.02, whereby the member may be expanded by a force below 100000 lbs.

[0053] According to another aspect of the present invention, an expandable tubular member has been provided that includes a lubricant resulting in a friction coefficient of 0.125, a wall thickness of approximately 0.305 inches, and an expansion force of approximately 146000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 25 and a collapse strength of approximately 2400 ksi.

[0054] According to another aspect of the present invention, an expandable tubular member has been provided that includes a lubricant resulting in a friction coefficient of 0.0.075, a wall thickness of approximately 0.350 inches, and an expansion force of approximately 143000

lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 22 and a collapse strength of approximately 3250 ksi.

[0055] According to another aspect of the present invention, an expandable tubular member has been provided that includes a lubricant resulting in a friction coefficient of 0.02, a wall thickness of approximately 0.450 inches, and an expansion force of approximately 150000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 17 and a collapse strength of approximately 5800 ksi.

[0056] According to another aspect of the present invention, an expandable tubular member has been provided that includes a lubricant resulting in a friction coefficient of 0.02, a wall thickness of approximately 0.5 inches, and an expansion force of approximately 126000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 15 and a collapse strength of approximately 5350 ksi.

[0057] According to another aspect of the present invention, an expandable tubular member has been provided that includes a lubricant resulting in a friction coefficient of 0.02, a wall thickness of approximately 0.5 inches, and an expansion force of approximately 127000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 15 and a collapse strength of approximately 8400 ksi.

[0058] According to another aspect of the present invention, an expandable tubular member has been provided that includes a composition, by weight percentage, of 0.065% C, 1.44% Mn, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.04% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti.

[0059] According to another aspect of the present invention, an expandable tubular member has been provided that includes a composition, by weight percentage, of 0.18% C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.03% V, 0.03% Mo, 0.01% Nb, and 0.01% Ti.

[0060] According to another aspect of the present invention, an expandable tubular member has been provided that includes a composition, by weight percentage, of 0.08% C, 0.82% Mn, 0.006% P, 0.003% S, 0.3% Si, 0.16% Cu, 0.05% Ni, 0.05% Cr, 0.06% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti.

[0061] According to another aspect of the present invention, an expandable tubular member has been provided that includes a composition, by weight percentage, of 0.03% C, 1.48% Mn, 0.014% P, 0.002% S, 0.16% Si, 0.02% Cu, 0.01% Ni, 0.02% Cr, 0.06% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti.

[0062] According to another aspect of the present invention, an expandable tubular member has been provided that includes, after a 16% expansion, approximately a 21% change in yield strength, approximately a 24% change in yield ratio, approximately a 18% change in elongation percentage, approximately a 8% change in width reduction percentage,

approximately a 15% change in wall thickness reduction percentage, and approximately a 4% change in anisotropy.

[0063] According to another aspect of the present invention, an expandable tubular member has been provided that includes, after a 15.6% expansion, approximately a 70% change in yield strength, approximately a 25% change in yield ratio, approximately a 67% change in elongation percentage, approximately a 28% change in width reduction percentage, approximately a 7% change in wall thickness reduction percentage, and approximately a 75% change in anisotropy.

[0064] According to another aspect of the present invention, an expandable tubular member has been provided that includes, after a 24% expansion, approximately a 5% change in yield strength, approximately a 11% change in yield ratio, approximately a 20% change in elongation percentage, approximately a 43% change in width reduction percentage, approximately a 2% change in wall thickness reduction percentage, and approximately a 52% change in anisotropy.

[0065] According to another aspect of the present invention, an expandable tubular member has been provided that includes, after a 24% expansion, approximately a 10% change in yield strength, approximately a 3% change in yield ratio, approximately a 30% change in elongation percentage, approximately a 13% change in width reduction percentage, approximately a 2% change in wall thickness reduction percentage, and approximately a 17% change in anisotropy.

[0066] According to another aspect of the present invention, an expandable tubular member has been provided that includes, after a 24% expansion, approximately a 46% change in yield strength, approximately a 20% change in yield ratio, approximately a 91% change in elongation percentage, approximately a 15% change in width reduction percentage, approximately a 2% change in wall thickness reduction percentage, and approximately a 18% change in anisotropy.

[0067] According to another aspect of the present invention, an expandable tubular member has been provided that includes, after a 16% expansion, approximately a 38% change in yield strength, approximately a 20% change in yield ratio, approximately a 11% change in elongation percentage, approximately a 9% change in width reduction percentage, approximately a 4% change in wall thickness reduction percentage, and approximately a 4% change in anisotropy.

[0068] According to another aspect of the present invention, an expandable tubular member has been provided that includes, after a 24% expansion, approximately a 31% change in yield strength, approximately a 14% change in yield ratio, approximately a 48% change in elongation percentage, approximately a 13% change in width reduction percentage,

approximately a 2% change in wall thickness reduction percentage, and approximately a 12% change in anisotropy.

[0069] According to another aspect of the present invention, an expandable tubular member has been provided that includes, after a 24% expansion, approximately a 38% change in yield strength, approximately a 21% change in yield ratio, approximately a 55% change in elongation percentage, approximately a 16% change in width reduction percentage, approximately a 9% change in wall thickness reduction percentage, and approximately a 13% change in anisotropy.

[0070] According to another aspect of the present invention, an expandable tubular member has been provided that includes, after a 16% expansion, approximately a 33% change in yield strength, approximately a 26% change in yield ratio, approximately a 30% change in elongation percentage, approximately a 15% change in width reduction percentage, approximately a 9% change in wall thickness reduction percentage, and approximately a 10% change in anisotropy.

[0071] According to another aspect of the present invention, an expandable tubular member has been provided that includes, after a 24% expansion, approximately a 41% change in yield strength, approximately a 27 % change in yield ratio, approximately a 40% change in elongation percentage, approximately a 21% change in width reduction percentage, approximately a 16% change in wall thickness reduction percentage, and approximately a 5% change in anisotropy.

[0072] According to another aspect of the present invention, an expandable tubular member has been provided that includes a tensile strength of approximately 80 ksi after 16% expansion, and a tensile strength of approximately 82 ksi after 24% expansion.

[0073] According to another aspect of the present invention, an expandable tubular member has been provided that includes a tensile strength of approximately 82 ksi after 16% expansion, and a tensile strength of approximately 88 ksi after 24% expansion.

[0074] According to another aspect of the present invention, an expandable tubular member has been provided that includes a tensile strength of approximately 80 ksi before expansion, a tensile strength of approximately 90 ksi after 16% expansion, and a tensile strength of approximately 92 ksi after 24% expansion.

[0075] According to another aspect of the present invention, an expandable tubular member has been provided that includes a tensile strength of approximately 115 ksi before expansion, a tensile strength of approximately 120 ksi after 15.2% expansion; and a tensile strength of approximately 121 ksi after 25.2% expansion.

[0076] According to another aspect of the present invention, an expandable tubular member has been provided that includes a tensile strength of approximately 100 ksi before expansion, and a tensile strength of approximately 26 ksi after 31.3% expansion.

[0077] According to another aspect of the present invention, an expandable tubular member has been provided that includes a tensile strength of approximately 114 ksi before expansion, and a tensile strength of approximately 140 ksi after 15.6% expansion.

[0078] According to another aspect of the present invention, an expandable tubular member has been provided that includes, upon quenching in water at approximately 775 °C, a tensile strength of 94 ksi and a yield strength of 56 ksi.

[0079] According to another aspect of the present invention, an expandable tubular member has been provided that includes, upon quenching in water at approximately 790 °C, a tensile strength of 94 ksi and a yield strength of 59 ksi.

[0080] According to another aspect of the present invention, an expandable tubular member has been provided that includes, upon quenching in water at approximately 735 °C, a tensile strength of 94 ksi and a yield strength of 59 ksi.

[0081] According to another aspect of the present invention, an expandable tubular member has been provided that includes, upon quenching in oil at approximately 775 °C, a tensile strength of 84 ksi and a yield strength of 49 ksi.

[0082] According to another aspect of the present invention, an expandable tubular member has been provided that includes, upon quenching in oil at approximately 820 °C, a tensile strength of 82 ksi and a yield strength of 61 ksi.

[0083] According to another aspect of the present invention, an expandable tubular member has been provided that includes, upon quenching in oil at approximately 750 °C, a tensile strength of 109 ksi and a yield strength of 58 ksi.

[0084] According to another aspect of the present invention, an expandable tubular member has been provided that includes, by weight percentage, 0.1% C, 1.5% Mn, and 0.3% Si.

[0085] According to another aspect of the present invention, an expandable tubular member has been provided that includes martensite in the range of 15% to 30%.\

[0086] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 80 ksi, a yield strength to tensile strength ratio of approximately 0.86, a longitudinal elongation of approximately 14.8%, a width reduction of approximately 38%, a wall thickness reduction of approximately 43%, and an anisotropy of approximately 0.87.

[0087] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 81 ksi, a yield strength to tensile strength ratio of approximately 0.83, a longitudinal elongation of approximately 14.9%, a width reduction of approximately 38%, a wall thickness reduction of approximately 43%, and an anisotropy of approximately 0.83.

[0088] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 79 ksi, a yield strength to

tensile strength ratio of approximately 0.82, a longitudinal elongation of approximately 15.9%, a width reduction of approximately 44%, a wall thickness reduction of approximately 43%, and an anisotropy of approximately 1.03.

[0089] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 80 ksi, a yield strength to tensile strength ratio of approximately 0.83, a longitudinal elongation of approximately 15.3%, a width reduction of approximately 40%, a wall thickness reduction of approximately 43%, and an anisotropy of approximately 0.92.

[0090] According to another aspect of the present invention, an expandable tubular member has been provided that includes an elongation of approximately 21%, a width reduction of approximately 35%, a wall thickness reduction of approximately 38%, and an anisotropy of approximately 0.89.

[0091] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 77 ksi, a yield strength to tensile strength ratio of approximately 0.82, a longitudinal elongation of approximately 16%, a width reduction of approximately 32%, a wall thickness reduction of approximately 45%, and an anisotropy of approximately 0.65.

[0092] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 78 ksi, a yield strength to tensile strength ratio of approximately 0.8, a longitudinal elongation of approximately 16%, a width reduction of approximately 31%, a wall thickness reduction of approximately 45%, and an anisotropy of approximately 0.63.

[0093] According to another aspect of the present invention, an expandable tubular member has been provided that, upon quenching and tempering, includes a yield strength of approximately 84 ksi, a yield strength to tensile strength ratio of approximately 0.84, a longitudinal elongation of approximately 20.5%, a width reduction of approximately 40%, a wall thickness reduction of approximately 42%, and an anisotropy of approximately 0.94.

[0094] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 80 ksi, a yield strength to tensile strength ratio of approximately 0.72, an elongation of approximately 35%, a width reduction of approximately 35%, a wall thickness reduction of approximately 33%, and an anisotropy of approximately 0.92.

[0095] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 90 ksi, a yield strength to tensile strength ratio of approximately 0.88, an elongation of approximately 25%, a width reduction of approximately 22%, a wall thickness reduction of approximately 20%, and an anisotropy of approximately 1.1.

[0096] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 88 ksi, a yield strength to tensile strength ratio of approximately 0.87, an elongation of approximately 16%, a width reduction of approximately 24%, a wall thickness reduction of approximately 30%, and an anisotropy of approximately 0.76.

[0097] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 48 ksi, a yield strength to tensile strength ratio of approximately 0.73, an elongation of approximately 38%, a width reduction of approximately 43%, a wall thickness reduction of approximately 49%, and an anisotropy of approximately 0.83.

[0098] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 46 ksi, a yield strength to tensile strength ratio of approximately 0.69, an elongation of approximately 40%, a width reduction of approximately 50%, a wall thickness reduction of approximately 53%, and an anisotropy of approximately 0.93.

[0099] According to another aspect of the present invention, an expandable tubular member has been provided that includes a yield strength of approximately 53 ksi, a yield strength to tensile strength ratio of approximately 0.85, an elongation of approximately 49%, a width reduction of approximately 49%, a wall thickness reduction of approximately 46%, and an anisotropy of approximately 1.1.

[00100] According to another aspect of the present invention, an expandable tubular member has been provided that, upon quenching and tempering, includes, after a flare expansion of 42%, an absorbed energy in the longitudinal direction of 125, an absorbed energy in the transverse direction of 59, and an absorbed energy in the weld of 176.

[00101] According to another aspect of the present invention, an expandable tubular member has been provided that, upon quenching and tempering, includes, after a flare expansion of 52%, an absorbed energy in the longitudinal direction of 145, an absorbed energy in the transverse direction of 59, and an absorbed energy in the weld of 174.

Brief Description of the Drawings

[00102] Fig. 1 is a fragmentary cross sectional view of an exemplary embodiment of an expandable tubular member positioned within a preexisting structure.

[00103] Fig. 2 is a fragmentary cross sectional view of the expandable tubular member of Fig. 1 after positioning an expansion device within the expandable tubular member.

[00104] Fig. 3 is a fragmentary cross sectional view of the expandable tubular member of Fig. 2 after operating the expansion device within the expandable tubular member to radially expand and plastically deform a portion of the expandable tubular member.

[00105] Fig. 4 is a fragmentary cross sectional view of the expandable tubular member of

Fig. 3 after operating the expansion device within the expandable tubular member to radially expand and plastically deform another portion of the expandable tubular member.

[00106] Fig. 5 is a graphical illustration of exemplary embodiments of the stress/strain curves for several portions of the expandable tubular member of Figs. 1-4.

[00107] Fig. 6 is a graphical illustration of the an exemplary embodiment of the yield strength vs. ductility curve for at least a portion of the expandable tubular member of Figs. 1-4.

[00108] Fig. 7 is a fragmentary cross sectional illustration of an embodiment of a series of overlapping expandable tubular members.

[00109] Fig. 8 is a fragmentary cross sectional view of an exemplary embodiment of an expandable tubular member positioned within a preexisting structure.

[00110] Fig. 9 is a fragmentary cross sectional view of the expandable tubular member of Fig. 8 after positioning an expansion device within the expandable tubular member.

[00111] Fig. 10 is a fragmentary cross sectional view of the expandable tubular member of Fig. 9 after operating the expansion device within the expandable tubular member to radially expand and plastically deform a portion of the expandable tubular member.

[00112] Fig. 11 is a fragmentary cross sectional view of the expandable tubular member of Fig. 10 after operating the expansion device within the expandable tubular member to radially expand and plastically deform another portion of the expandable tubular member.

[00113] Fig. 12 is a graphical illustration of exemplary embodiments of the stress/strain curves for several portions of the expandable tubular member of Figs. 8-11.

[00114] Fig. 13 is a graphical illustration of an exemplary embodiment of the yield strength vs. ductility curve for at least a portion of the expandable tubular member of Figs. 8-11.

[00115] Fig. 14 is a fragmentary cross sectional view of an exemplary embodiment of an expandable tubular member positioned within a preexisting structure.

[00116] Fig. 15 is a fragmentary cross sectional view of the expandable tubular member of Fig. 14 after positioning an expansion device within the expandable tubular member.

[00117] Fig. 16 is a fragmentary cross sectional view of the expandable tubular member of Fig. 15 after operating the expansion device within the expandable tubular member to radially expand and plastically deform a portion of the expandable tubular member.

[00118] Fig. 17 is a fragmentary cross sectional view of the expandable tubular member of Fig. 16 after operating the expansion device within the expandable tubular member to radially expand and plastically deform another portion of the expandable tubular member.

[00119] Fig. 18 is a flow chart illustration of an exemplary embodiment of a method of processing an expandable tubular member.

[00120] Fig. 19 is a graphical illustration of the an exemplary embodiment of the yield

strength vs. ductility curve for at least a portion of the expandable tubular member during the operation of the method of Fig. 18.

[00121] Fig. 20 is a graphical illustration of stress/strain curves for an exemplary embodiment of an expandable tubular member.

[00122] Fig. 21 is a graphical illustration of stress/strain curves for an exemplary embodiment of an expandable tubular member.

[00123] Fig. 22 is a fragmentary cross-sectional view illustrating an embodiment of the radial expansion and plastic deformation of a portion of a first tubular member having an internally threaded connection at an end portion, an embodiment of a tubular sleeve supported by the end portion of the first tubular member, and a second tubular member having an externally threaded portion coupled to the internally threaded portion of the first tubular member and engaged by a flange of the sleeve. The sleeve includes the flange at one end for increasing axial compression loading.

[00124] Fig. 23 is a fragmentary cross-sectional view illustrating an embodiment of the radial expansion and plastic deformation of a portion of a first tubular member having an internally threaded connection at an end portion, a second tubular member having an externally threaded portion coupled to the internally threaded portion of the first tubular member, and an embodiment of a tubular sleeve supported by the end portion of both tubular members. The sleeve includes flanges at opposite ends for increasing axial tension loading.

[00125] Fig. 24 is a fragmentary cross-sectional illustration of the radial expansion and plastic deformation of a portion of a first tubular member having an internally threaded connection at an end portion, a second tubular member having an externally threaded portion coupled to the internally threaded portion of the first tubular member, and an embodiment of a tubular sleeve supported by the end portion of both tubular members. The sleeve includes flanges at opposite ends for increasing axial compression/tension loading.

[00126] Fig. 25 is a fragmentary cross-sectional illustration of the radial expansion and plastic deformation of a portion of a first tubular member having an internally threaded connection at an end portion, a second tubular member having an externally threaded portion coupled to the internally threaded portion of the first tubular member, and an embodiment of a tubular sleeve supported by the end portion of both tubular members. The sleeve includes flanges at opposite ends having sacrificial material thereon.

[00127] Fig. 26 is a fragmentary cross-sectional illustration of the radial expansion and plastic deformation of a portion of a first tubular member having an internally threaded connection at an end portion, a second tubular member having an externally threaded portion coupled to the internally threaded portion of the first tubular member, and an

embodiment of a tubular sleeve supported by the end portion of both tubular members. The sleeve includes a thin walled cylinder of sacrificial material.

[00128] Fig. 27 is a fragmentary cross-sectional illustration of the radial expansion and plastic deformation of a portion of a first tubular member having an internally threaded connection at an end portion, a second tubular member having an externally threaded portion coupled to the internally threaded portion of the first tubular member, and an embodiment of a tubular sleeve supported by the end portion of both tubular members. The sleeve includes a variable thickness along the length thereof.

[00129] Fig. 28 is a fragmentary cross-sectional illustration of the radial expansion and plastic deformation of a portion of a first tubular member having an internally threaded connection at an end portion, a second tubular member having an externally threaded portion coupled to the internally threaded portion of the first tubular member, and an embodiment of a tubular sleeve supported by the end portion of both tubular members. The sleeve includes a member coiled onto grooves formed in the sleeve for varying the sleeve thickness.

[00130] Fig. 29 is a fragmentary cross-sectional illustration of an exemplary embodiment of an expandable connection.

[00131] Figs. 30a-30c are fragmentary cross-sectional illustrations of exemplary embodiments of expandable connections.

[00132] Fig. 31 is a fragmentary cross-sectional illustration of an exemplary embodiment of an expandable connection.

[00133] Figs. 32a and 32b are fragmentary cross-sectional illustrations of the formation of an exemplary embodiment of an expandable connection.

[00134] Fig. 33 is a fragmentary cross-sectional illustration of an exemplary embodiment of an expandable connection.

[00135] Figs. 34a, 34b and 34c are fragmentary cross-sectional illustrations of an exemplary embodiment of an expandable connection.

[00136] Fig. 35a is a fragmentary cross-sectional illustration of an exemplary embodiment of an expandable tubular member.

[00137] Fig. 35b is a graphical illustration of an exemplary embodiment of the variation in the yield point for the expandable tubular member of Fig. 35a.

[00138] Fig. 36a is a flow chart illustration of an exemplary embodiment of a method for processing a tubular member.

[00139] Fig. 36b is an illustration of the microstructure of an exemplary embodiment of a tubular member prior to thermal processing.

[00140] Fig. 36c is an illustration of the microstructure of an exemplary embodiment of a tubular member after thermal processing.

[00141] Fig. 37a is a flow chart illustration of an exemplary embodiment of a method for processing a tubular member.

[00142] Fig. 37b is an illustration of the microstructure of an exemplary embodiment of a tubular member prior to thermal processing.

[00143] Fig. 37c is an illustration of the microstructure of an exemplary embodiment of a tubular member after thermal processing.

[00144] Fig. 38a is a flow chart illustration of an exemplary embodiment of a method for processing a tubular member.

[00145] Fig. 38b is an illustration of the microstructure of an exemplary embodiment of a tubular member prior to thermal processing.

[00146] Fig. 38c is an illustration of the microstructure of an exemplary embodiment of a tubular member after thermal processing.

[00147] Fig. 39 is an illustration of an exemplary embodiment of a method for manufacturing an expandable tubular member.

[00148] Fig. 40 is an illustration of an exemplary embodiment of a method for expanding an expandable tubular member.

[00149] Fig. 41 is an illustration of an exemplary embodiment of a method for formability evaluation.

[00150] Fig. 42 is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00151] Fig. 43 is an illustration of an exemplary embodiment of a method for transforming the yield strength of an expandable tubular member.

[00152] Fig. 44 is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00153] Fig. 45 is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00154] Fig. 46 is an illustration of an exemplary embodiment of a method for manufacturing an expandable tubular member.

[00155] Fig. 47 is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00156] Fig. 48 is an illustration of an exemplary embodiment of a lubricated expandable tubular member.

[00157] Fig. 49 is an illustration of an exemplary embodiment of the force needed to expand a plurality of lubricated tubular members.

[00158] Fig. 50a is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00159] Fig. 50b is an illustration of the stress strain properties of a plurality of expandable tubular members.

[00160] Fig. 51 is an illustration of an exemplary embodiment of the force needed to expand a plurality of tubular members including different lubricants.

[00161] Fig. 52 is an illustration of an exemplary embodiment of the collapse strength of a plurality of tubular members including different lubricants.

[00162] Fig. 53 is an illustration of an exemplary embodiment of a plurality of expandable tubular members of different compositions.

[00163] Fig. 54 is an illustration of an exemplary experimental embodiment of the tensile characteristics of an expandable tubular member before and after 16% expansion.

[00164] Fig. 55 is an illustration of an exemplary experimental embodiment of the tensile characteristics of an expandable tubular member before and after 15.6% expansion.

[00165] Fig. 56 is an illustration of an exemplary experimental embodiment of the tensile characteristics of an expandable tubular member before and after 24% expansion.

[00166] Fig. 57 is an illustration of an exemplary experimental embodiment of the tensile characteristics of an expandable tubular member before and after 16% and 24% expansion.

[00167] Fig. 58 is an illustration of an exemplary experimental embodiment of the tensile characteristics of an expandable tubular member before and after 16% expansion.

[00168] Fig. 59 is an illustration of an exemplary experimental embodiment of the tensile characteristics of an expandable tubular member before and after 24% expansion.

[00169] Fig. 60 is an illustration of an exemplary experimental embodiment of the tensile characteristics of an expandable tubular member before and after 16% and 24% expansion.

[00170] Fig. 61 is an illustration of an exemplary experimental embodiment of the tensile characteristics of an expandable tubular member before and after 16% expansion.

[00171] Fig. 62 is an illustration of an exemplary experimental embodiment of the tensile characteristics of an expandable tubular member before and after 24% expansion.

[00172] Fig. 63 is an illustration of an exemplary experimental embodiment of the stress/strain curve for an expandable tubular member before expansion, after 16% expansion, and after 24% expansion.

[00173] Fig. 64 is an illustration of an exemplary experimental embodiment of the stress/strain curve for an expandable tubular member before expansion, after 16% expansion, and after 24% expansion.

[00174] Fig. 65 is an illustration of an exemplary experimental embodiment of the stress/strain curve for an expandable tubular member before expansion, after 16% expansion, and after 24% expansion.

[00175] Fig. 66 is an illustration of an exemplary experimental embodiment of the stress/strain curve for an expandable tubular member before expansion, after 15.2% expansion, and after 25.2% expansion.

[00176] Fig. 67 is an illustration of an exemplary experimental embodiment of the stress/strain curve for an expandable tubular member before expansion and after 31.3% expansion.

[00177] Fig. 68a is an illustration of an exemplary experimental embodiment of the stress/strain curve for an expandable tubular member before expansion and after 15.6% expansion.

[00178] Fig. 68b is an illustration of the properties of an expandable tubular member.

[00179] Fig. 69 is an illustration of an exemplary experimental embodiment of the tensile and yield strength of a tubular member before and after quenching in water at approximately 775 °C.

[00180] Fig. 70 is an illustration of an exemplary experimental embodiment of the tensile and yield strength of a tubular member before and after quenching in water at approximately 790 °C.

[00181] Fig. 71 is an illustration of an exemplary experimental embodiment of the tensile and yield strength of a tubular member before and after quenching in water at approximately 735 °C.

[00182] Fig. 72 is an illustration of an exemplary experimental embodiment of the tensile and yield strength of a tubular member before and after quenching in oil at approximately 775 °C.

[00183] Fig. 73 is an illustration of an exemplary experimental embodiment of the tensile and yield strength of a tubular member before and after quenching in oil at approximately 820 °C.

[00184] Fig. 74 is an illustration of an exemplary experimental embodiment of the tensile and yield strength of a tubular member before and after quenching in oil at approximately 750 °C.

[00185] Fig. 75 is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00186] Fig. 76 is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00187] Fig. 77a is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00188] Fig. 77b is an illustration of an exemplary embodiment of the stress-strain curve for an expandable tubular member.

[00189] Fig. 78a is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00190] Fig. 78b is an illustration of an exemplary embodiment of the stress-strain curve for an expandable tubular member.

[00191] Fig. 79a is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00192] Fig. 79b is an illustration of an exemplary embodiment of the stress-strain curve for an expandable tubular member.

[00193] Fig. 80a is an illustration of an exemplary embodiment of the properties of an expandable tubular member.

[00194] Fig. 80b is an illustration of an exemplary embodiment of the stress-strain curve for an expandable tubular member.

[00195] Fig. 81 is an illustration of an exemplary embodiment of the properties for a plurality of expandable tubular members.

[00196] Fig. 82 is an illustration of an exemplary embodiment of the properties for a plurality of quenched and tempered expandable tubular members.

Detailed Description of the Illustrative Embodiments

[00197] Referring initially to Fig. 1, an exemplary embodiment of an expandable tubular assembly 10 includes a first expandable tubular member 12 coupled to a second expandable tubular member 14. In several exemplary embodiments, the ends of the first and second expandable tubular members, 12 and 14, are coupled using, for example, a conventional mechanical coupling, a welded connection, a brazed connection, a threaded connection, and/or an interference fit connection. In an exemplary embodiment, the first expandable tubular member 12 has a plastic yield point YP_1, and the second expandable tubular member 14 has a plastic yield point YP_2. In an exemplary embodiment, the expandable tubular assembly 10 is positioned within a preexisting structure such as, for example, a wellbore 16 that traverses a subterranean formation 18.

[00198] As illustrated in Fig. 2, an expansion device 20 may then be positioned within the second expandable tubular member 14. In several exemplary embodiments, the expansion device 20 may include, for example, one or more of the following conventional expansion devices: a) an expansion cone; b) a rotary expansion device; c) a hydroforming expansion device; d) an impulsive force expansion device; d) any one of the expansion devices commercially available from, or disclosed in any of the published patent applications or issued patents, of Weatherford International, Baker Hughes, Halliburton Energy Services, Shell Oil Co., Schlumberger, and/or Enventure Global Technology L.L.C. In several exemplary embodiments, the expansion device 20 is positioned within the second expandable tubular member 14 before, during, or after the placement of the expandable

tubular assembly 10 within the preexisting structure 16.

[00199] As illustrated in Fig. 3, the expansion device 20 may then be operated to radially expand and plastically deform at least a portion of the second expandable tubular member 14 to form a bell-shaped section.

[00200] As illustrated in Fig. 4, the expansion device 20 may then be operated to radially expand and plastically deform the remaining portion of the second expandable tubular member 14 and at least a portion of the first expandable tubular member 12.

[00201] In an exemplary embodiment, at least a portion of at least a portion of at least one of the first and second expandable tubular members, 12 and 14, are radially expanded into intimate contact with the interior surface of the preexisting structure 16.

[00202] In an exemplary embodiment, as illustrated in Fig. 5, the plastic yield point YP_1 is greater than the plastic yield point YP_2. In this manner, in an exemplary embodiment, the amount of power and/or energy required to radially expand the second expandable tubular member 14 is less than the amount of power and/or energy required to radially expand the first expandable tubular member 12.

[00203] In an exemplary embodiment, as illustrated in Fig. 6, the first expandable tubular member 12 and/or the second expandable tubular member 14 have a ductility D_{PE} and a yield strength YS_{PE} prior to radial expansion and plastic deformation, and a ductility D_{AE} and a yield strength YS_{AE} after radial expansion and plastic deformation. In an exemplary embodiment, D_{PE} is greater than D_{AE}, and YS_{AE} is greater than YS_{PE}. In this manner, the first expandable tubular member 12 and/or the second expandable tubular member 14 are transformed during the radial expansion and plastic deformation process. Furthermore, in this manner, in an exemplary embodiment, the amount of power and/or energy required to radially expand each unit length of the first and/or second expandable tubular members, 12 and 14, is reduced. Furthermore, because the YS_{AE} is greater than YS_{PE}, the collapse strength of the first expandable tubular member 12 and/or the second expandable tubular member 14 is increased after the radial expansion and plastic deformation process.

[00204] In an exemplary embodiment, as illustrated in Fig. 7, following the completion of the radial expansion and plastic deformation of the expandable tubular assembly 10 described above with reference to Figs. 1-4, at least a portion of the second expandable tubular member 14 has an inside diameter that is greater than at least the inside diameter of the first expandable tubular member 12. In this manner a bell-shaped section is formed using at least a portion of the second expandable tubular member 14. Another expandable tubular assembly 22 that includes a first expandable tubular member 24 and a second expandable tubular member 26 may then be positioned in overlapping relation to the first expandable tubular assembly 10 and radially expanded and plastically deformed using the methods described above with reference to Figs. 1-4. Furthermore, following the completion

of the radial expansion and plastic deformation of the expandable tubular assembly 20, in an exemplary embodiment, at least a portion of the second expandable tubular member 26 has an inside diameter that is greater than at least the inside diameter of the first expandable tubular member 24. In this manner a bell-shaped section is formed using at least a portion of the second expandable tubular member 26. Furthermore, in this manner, a mono-diameter tubular assembly is formed that defines an internal passage 28 having a substantially constant cross-sectional area and/or inside diameter.

[00205] Referring to Fig. 8, an exemplary embodiment of an expandable tubular assembly 100 includes a first expandable tubular member 102 coupled to a tubular coupling 104. The tubular coupling 104 is coupled to a tubular coupling 106. The tubular coupling 106 is coupled to a second expandable tubular member 108. In several exemplary embodiments, the tubular couplings, 104 and 106, provide a tubular coupling assembly for coupling the first and second expandable tubular members, 102 and 108, together that may include, for example, a conventional mechanical coupling, a welded connection, a brazed connection, a threaded connection, and/or an interference fit connection. In an exemplary embodiment, the first and second expandable tubular members 12 have a plastic yield point YP_1, and the tubular couplings, 104 and 106, have a plastic yield point YP_2. In an exemplary embodiment, the expandable tubular assembly 100 is positioned within a preexisting structure such as, for example, a wellbore 110 that traverses a subterranean formation 112.

[00206] As illustrated in Fig. 9, an expansion device 114 may then be positioned within the second expandable tubular member 108. In several exemplary embodiments, the expansion device 114 may include, for example, one or more of the following conventional expansion devices: a) an expansion cone; b) a rotary expansion device; c) a hydroforming expansion device; d) an impulsive force expansion device; d) any one of the expansion devices commercially available from, or disclosed in any of the published patent applications or issued patents, of Weatherford International, Baker Hughes, Halliburton Energy Services, Shell Oil Co., Schlumberger, and/or Enventure Global Technology L.L.C. In several exemplary embodiments, the expansion device 114 is positioned within the second expandable tubular member 108 before, during, or after the placement of the expandable tubular assembly 100 within the preexisting structure 110.

[00207] As illustrated in Fig. 10, the expansion device 114 may then be operated to radially expand and plastically deform at least a portion of the second expandable tubular member 108 to form a bell-shaped section.

[00208] As illustrated in Fig. 11, the expansion device 114 may then be operated to radially expand and plastically deform the remaining portion of the second expandable tubular member 108, the tubular couplings, 104 and 106, and at least a portion of the first expandable tubular member 102.

[00209] In an exemplary embodiment, at least a portion of at least a portion of at least one of the first and second expandable tubular members, 102 and 108, are radially expanded into intimate contact with the interior surface of the preexisting structure 110.

[00210] In an exemplary embodiment, as illustrated in Fig. 12, the plastic yield point YP_1 is less than the plastic yield point YP_2. In this manner, in an exemplary embodiment, the amount of power and/or energy required to radially expand each unit length of the first and second expandable tubular members, 102 and 108, is less than the amount of power and/or energy required to radially expand each unit length of the tubular couplings, 104 and 106.

[00211] In an exemplary embodiment, as illustrated in Fig. 13, the first expandable tubular member 12 and/or the second expandable tubular member 14 have a ductility D_{PE} and a yield strength YS_{PE} prior to radial expansion and plastic deformation, and a ductility D_{AE} and a yield strength YS_{AE} after radial expansion and plastic deformation. In an exemplary embodiment, D_{PE} is greater than D_{AE}, and YS_{AE} is greater than YS_{PE}. In this manner, the first expandable tubular member 12 and/or the second expandable tubular member 14 are transformed during the radial expansion and plastic deformation process. Furthermore, in this manner, in an exemplary embodiment, the amount of power and/or energy required to radially expand each unit length of the first and/or second expandable tubular members, 12 and 14, is reduced. Furthermore, because the YS_{AE} is greater than YS_{PE}, the collapse strength of the first expandable tubular member 12 and/or the second expandable tubular member 14 is increased after the radial expansion and plastic deformation process.

[00212] Referring to Fig. 14, an exemplary embodiment of an expandable tubular assembly 200 includes a first expandable tubular member 202 coupled to a second expandable tubular member 204 that defines radial openings 204a, 204b, 204c, and 204d. In several exemplary embodiments, the ends of the first and second expandable tubular members, 202 and 204, are coupled using, for example, a conventional mechanical coupling, a welded connection, a brazed connection, a threaded connection, and/or an interference fit connection. In an exemplary embodiment, one or more of the radial openings, 204a, 204b, 204c, and 204d, have circular, oval, square, and/or irregular cross sections and/or include portions that extend to and interrupt either end of the second expandable tubular member 204. In an exemplary embodiment, the expandable tubular assembly 200 is positioned within a preexisting structure such as, for example, a wellbore 206 that traverses a subterranean formation 208.

[00213] As illustrated in Fig. 15, an expansion device 210 may then be positioned within the second expandable tubular member 204. In several exemplary embodiments, the expansion device 210 may include, for example, one or more of the following conventional expansion devices: a) an expansion cone; b) a rotary expansion device; c) a hydroforming expansion device; d) an impulsive force expansion device; d) any one of the expansion

devices commercially available from, or disclosed in any of the published patent applications or issued patents, of Weatherford International, Baker Hughes, Halliburton Energy Services, Shell Oil Co., Schlumberger, and/or Enventure Global Technology L.L.C. In several exemplary embodiments, the expansion device 210 is positioned within the second expandable tubular member 204 before, during, or after the placement of the expandable tubular assembly 200 within the preexisting structure 206.

[00214] As illustrated in Fig. 16, the expansion device 210 may then be operated to radially expand and plastically deform at least a portion of the second expandable tubular member 204 to form a bell-shaped section.

[00215] As illustrated in Fig. 16, the expansion device 20 may then be operated to radially expand and plastically deform the remaining portion of the second expandable tubular member 204 and at least a portion of the first expandable tubular member 202.

[00216] In an exemplary embodiment, the anisotropy ratio AR for the first and second expandable tubular members is defined by the following equation:

$AR = \ln (WT_f/WT_o)/\ln (D_f/D_o)$;

where AR = anisotropy ratio;

where WT_f = final wall thickness of the expandable tubular member following the radial expansion and plastic deformation of the expandable tubular member;

where WT_i = initial wall thickness of the expandable tubular member prior to the radial expansion and plastic deformation of the expandable tubular member;

where D_f = final inside diameter of the expandable tubular member following the radial expansion and plastic deformation of the expandable tubular member; and

where D_i = initial inside diameter of the expandable tubular member prior to the radial expansion and plastic defomation of the expandable tubular member.

[00217] In an exemplary embodiment, the anisotropy ratio AR for the first and/or second expandable tubular members, 204 and 204, is greater than 1.

[00218] In an exemplary experimental embodiment, the second expandable tubular member 204 had an anisotropy ratio AR greater than 1, and the radial expansion and plastic deformation of the second expandable tubular member did not result in any of the openings, 204a, 204b, 204c, and 204d, splitting or otherwise fracturing the remaining portions of the second expandable tubular member. This was an unexpected result.

[00219] Referring to Fig. 18, in an exemplary embodiment, one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204 are processed using a method 300 in which a tubular member in an initial state is thermo-mechanically processed in step 302. In an exemplary embodiment, the thermo-mechanical processing 302 includes one or more heat treating and/or mechanical forming processes. As a result, of the thermo-mechanical processing 302, the tubular member is transformed to an intermediate state.

The tubular member is then further thermo-mechanically processed in step 304. In an exemplary embodiment, the thermo-mechanical processing 304 includes one or more heat treating and/or mechanical forming processes. As a result, of the thermo-mechanical processing 304, the tubular member is transformed to a final state.

[00220] In an exemplary embodiment, as illustrated in Fig. 19, during the operation of the method 300, the tubular member has a ductility D_{PE} and a yield strength YS_{PE} prior to the final thermo-mechanical processing in step 304, and a ductility D_{AE} and a yield strength YS_{AE} after final thermo-mechanical processing. In an exemplary embodiment, D_{PE} is greater than D_{AE}, and YS_{AE} is greater than YS_{PE}. In this manner, the amount of energy and/or power required to transform the tubular member, using mechanical forming processes, during the final thermo-mechanical processing in step 304 is reduced. Furthermore, in this manner, because the YS_{AE} is greater than YS_{PE}, the collapse strength of the tubular member is increased after the final thermo-mechanical processing in step 304.

[00221] In an exemplary embodiment, one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204, have the following characteristics:

Characteristic	Value
Tensile Strength	60 to 120 ksi
Yield Strength	50 to 100 ksi
Y/T Ratio	Maximum of 50/85 %
Elongation During Radial Expansion and Plastic Deformation	Minimum of 35 %
Width Reduction During Radial Expansion and Plastic Deformation	Minimum of 40 %
Wall Thickness Reduction During Radial Expansion and Plastic Deformation	Minimum of 30 %
Anisotropy	Minimum of 1.5
Minimum Absorbed Energy at -4 F (-20 C) in the Longitudinal Direction	80 ft-lb
Minimum Absorbed Energy at -4 F (-20 C) in the Transverse Direction	60 ft-lb

Characteristic	Value
Minimum Absorbed Energy at -4 F (-20 C) Transverse To A Weld Area	60 ft-lb
Flare Expansion Testing	Minimum of 75% Without A Failure
Increase in Yield Strength Due To Radial Expansion and Plastic Deformation	Greater than 5.4 %

[00222] In an exemplary embodiment, one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204, are characterized by an expandability coefficient f:

i. f = r X n
ii. where f = expandability coefficient;
  1. r = anisotropy coefficient; and
  2. n = strain hardening exponent.

[00223] In an exemplary embodiment, the anisotropy coefficient for one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204 is greater than 1. In an exemplary embodiment, the strain hardening exponent for one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204 is greater than 0.12. In an exemplary embodiment, the expandability coefficient for one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204 is greater than 0.12.

[00224] In an exemplary embodiment, a tubular member having a higher expandability coefficient requires less power and/or energy to radially expand and plastically deform each unit length than a tubular member having a lower expandability coefficient. In an exemplary embodiment, a tubular member having a higher expandability coefficient requires less power and/or energy per unit length to radially expand and plastically deform than a tubular member having a lower expandability coefficient.

[00225] In several exemplary experimental embodiments, one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204, are steel alloys having one of the following compositions:

	Element and Percentage By Weight							
Steel Alloy	C	Mn	P	S	Si	Cu	Ni	Cr
A	0.065	1.44	0.01	0.002	0.24	0.01	0.01	0.02

B	0.18	1.28	0.017	0.004	0.29	0.01	0.01	0.03
C	0.08	0.82	0.006	0.003	0.30	0.16	0.05	0.05
D	0.02	1.31	0.02	0.001	0.45	-	9.1	18.7

[00226] In exemplary experimental embodiment, as illustrated in Fig. 20, a sample of an expandable tubular member composed of Alloy A exhibited a yield point before radial expansion and plastic deformation YP_{BE}, a yield point after radial expansion and plastic deformation of about 16 % $YP_{AE16\%}$, and a yield point after radial expansion and plastic deformation of about 24 % $YP_{AE24\%}$. In an exemplary experimental embodiment, $YP_{AE24\%} > YP_{AE16\%} > YP_{BE}$. Furthermore, in an exemplary experimental embodiment, the ductility of the sample of the expandable tubular member composed of Alloy A also exhibited a higher ductility prior to radial expansion and plastic deformation than after radial expansion and plastic deformation. These were unexpected results.

[00227] In an exemplary experimental embodiment, a sample of an expandable tubular member composed of Alloy A exhibited the following tensile characteristics before and after radial expansion and plastic deformation:

	Yield Point ksi	**Yield Ratio**	**Elongation %**	**Width Reduction %**	**Wall Thickness Reduction %**	**Anisotropy**
Before Radial Expansion and Plastic Deformation	46.9	0.69	53	-52	55	0.93
After 16% Radial Expansion	65.9	0.83	17	42	51	0.78
After 24% Radial Expansion	68.5	0.83	5	44	54	0.76

	Yield Point ksi	Yield Ratio	Elongation %	Width Reduction %	Wall Thickness Reduction %	Anisotropy
% Increase	40% for 16% radial expansion 46% for 24% radial expansion					

[00228] In exemplary experimental embodiment, as illustrated in Fig. 21, a sample of an expandable tubular member composed of Alloy B exhibited a yield point before radial expansion and plastic deformation YP_{BE}, a yield point after radial expansion and plastic deformation of about 16 % $YP_{AE16\%}$, and a yield point after radial expansion and plastic deformation of about 24 % $YP_{AE24\%}$. In an exemplary embodiment, $YP_{AE24\%} > YP_{AE16\%} > YP_{BE}$. Furthermore, in an exemplary experimental embodiment, the ductility of the sample of the expandable tubular member composed of Alloy B also exhibited a higher ductility prior to radial expansion and plastic deformation than after radial expansion and plastic deformation. These were unexpected results.

[00229] In an exemplary experimental embodiment, a sample of an expandable tubular member composed of Alloy B exhibited the following tensile characteristics before and after radial expansion and plastic deformation:

	Yield Point ksi	Yield Ratio	Elongation %	Width Reduction %	Wall Thickness Reduction %	Anisotropy
Before Radial Expansion and Plastic Deformation	57.8	0.71	44	43	46	0.93
After 16% Radial	74.4	0.84	16	38	42	0.87

	Yield Point ksi	Yield Ratio	Elongation %	Width Reduction %	Wall Thickness Reduction %	Anisotropy
Expansion						
After 24% Radial Expansion	79.8	0.86	20	36	42	0.81
% Increase	28.7% increase for 16% radial expansion 38% increase for 24% radial expansion					

[00230] In an exemplary experimental embodiment, samples of expandable tubulars composed of Alloys A, B, C, and D exhibited the following tensile characteristics prior to radial expansion and plastic deformation:

Steel Alloy	Yield ksi	Yield Ratio	Elongation %	Anisotropy	Absorbed Energy ft-lb	Expandability Coefficient
A	47.6	0.71	44	1.48	145	
B	57.8	0.71	44	1.04	62.2	
C	61.7	0.80	39	1.92	268	
D	48	0.55	56	1.34	-	

[00231] In an exemplary embodiment, one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204 have a strain hardening exponent greater than 0.12, and a yield ratio is less than 0.85.

[00232] In an exemplary embodiment, the carbon equivalent C_e, for tubular members having a carbon content (by weight percentage) less than or equal to 0.12%, is given by the following expression:

$$C_e = C + Mn/6 + (Cr + Mo + V + Ti + Nb)/5 + (Ni + Cu)/15$$

where C_e = carbon equivalent value;

a. C = carbon percentage by weight;

b. Mn = manganese percentage by weight;

c. Cr = chromium percentage by weight;

d. Mo = molybdenum percentage by weight;

e. V = vanadium percentage by weight;

f. Ti = titanium percentage by weight;

g. Nb = niobium percentage by weight;

h. Ni = nickel percentage by weight; and

i. Cu = copper percentage by weight.

[00233] In an exemplary embodiment, the carbon equivalent value C_e, for tubular members having a carbon content less than or equal to 0.12% (by weight), for one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204 is less than 0.21.

[00234] In an exemplary embodiment, the carbon equivalent C_e, for tubular members having more than 0.12% carbon content (by weight), is given by the following expression:

$$C_e = C + Si/30 + (Mn + Cu + Cr)/20 + Ni/60 + Mo/15 + V/10 + 5 * B$$

where C_e = carbon equivalent value;

a. C = carbon percentage by weight;

b. Si = silicon percentage by weight;

c. Mn = manganese percentage by weight;

d. Cu = copper percentage by weight;

e. Cr = chromium percentage by weight;

f. Ni = nickel percentage by weight;

g. Mo = molybdenum percentage by weight;

h. V = vanadium percentage by weight; and

i. B = boron percentage by weight.

[00235] In an exemplary embodiment, the carbon equivalent value C_e, for tubular members having greater than 0.12% carbon content (by weight), for one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204 is less than 0.36.

[00236] Referring to Fig. 22 in an exemplary embodiment, a first tubular member 2210 includes an internally threaded connection 2212 at an end portion 2214. A first end of a tubular sleeve 2216 that includes an internal flange 2218 having a tapered portion 2220, and a second end that includes a tapered portion 2222, is then mounted upon and receives the

end portion 2214 of the first tubular member 2210. In an exemplary embodiment, the end portion 2214 of the first tubular member 2210 abuts one side of the internal flange 2218 of the tubular sleeve 2216, and the internal diameter of the internal flange 2218 of the tubular sleeve 2216 is substantially equal to or greater than the maximum internal diameter of the internally threaded connection 2212 of the end portion 2214 of the first tubular member 2210. An externally threaded connection 2224 of an end portion 2226 of a second tubular member 2228 having an annular recess 2230 is then positioned within the tubular sleeve 2216 and threadably coupled to the internally threaded connection 2212 of the end portion 2214 of the first tubular member 2210. In an exemplary embodiment, the internal flange 2218 of the tubular sleeve 2216 mates with and is received within the annular recess 2230 of the end portion 2226 of the second tubular member 2228. Thus, the tubular sleeve 2216 is coupled to and surrounds the external surfaces of the first and second tubular members, 2210 and 2228.

[00237] The internally threaded connection 2212 of the end portion 2214 of the first tubular member 2210 is a box connection, and the externally threaded connection 2224 of the end portion 2226 of the second tubular member 2228 is a pin connection. In an exemplary embodiment, the internal diameter of the tubular sleeve 2216 is at least approximately .020" greater than the outside diameters of the first and second tubular members, 2210 and 2228. In this manner, during the threaded coupling of the first and second tubular members, 2210 and 2228, fluidic materials within the first and second tubular members may be vented from the tubular members.

[00238] As illustrated in Fig. 22, the first and second tubular members, 2210 and 2228, and the tubular sleeve 2216 may be positioned within another structure 2232 such as, for example, a cased or uncased wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating a conventional expansion device 2234 within and/or through the interiors of the first and second tubular members. The tapered portions, 2220 and 2222, of the tubular sleeve 2216 facilitate the insertion and movement of the first and second tubular members within and through the structure 2232, and the movement of the expansion device 2234 through the interiors of the first and second tubular members, 2210 and 2228, may be, for example, from top to bottom or from bottom to top.

[00239] During the radial expansion and plastic deformation of the first and second tubular members, 2210 and 2228, the tubular sleeve 2216 is also radially expanded and plastically deformed. As a result, the tubular sleeve 2216 may be maintained in circumferential tension and the end portions, 2214 and 2226, of the first and second tubular members, 2210 and 2228, may be maintained in circumferential compression.

[00240] Sleeve 2216 increases the axial compression loading of the connection between tubular members 2210 and 2228 before and after expansion by the expansion

device 2234. Sleeve 2216 may, for example, be secured to tubular members 2210 and 2228 by a heat shrink fit.

[00241] In several alternative embodiments, the first and second tubular members, 2210 and 2228, are radially expanded and plastically deformed using other conventional methods for radially expanding and plastically deforming tubular members such as, for example, internal pressurization, hydroforming, and/or roller expansion devices and/or any one or combination of the conventional commercially available expansion products and services available from Baker Hughes, Weatherford International, and/or Enventure Global Technology L.L.C.

[00242] The use of the tubular sleeve 2216 during (a) the coupling of the first tubular member 2210 to the second tubular member 2228, (b) the placement of the first and second tubular members in the structure 2232, and (c) the radial expansion and plastic deformation of the first and second tubular members provides a number of significant benefits. For example, the tubular sleeve 2216 protects the exterior surfaces of the end portions, 2214 and 2226, of the first and second tubular members, 2210 and 2228, during handling and insertion of the tubular members within the structure 2232. In this manner, damage to the exterior surfaces of the end portions, 2214 and 2226, of.the first and second tubular members, 2210 and 2228, is avoided that could otherwise result in stress concentrations that could cause a catastrophic failure during subsequent radial expansion operations. Furthermore, the tubular sleeve 2216 provides an alignment guide that facilitates the insertion and threaded coupling of the second tubular member 2228 to the first tubular member 2210. In this manner, misalignment that could result in damage to the threaded connections, 2212 and 2224, of the first and second tubular members, 2210 and 2228, may be avoided. In addition, during the relative rotation of the second tubular member with respect to the first tubular member, required during the threaded coupling of the first and second tubular members, the tubular sleeve 2216 provides an indication of to what degree the first and second tubular members are threadably coupled. For example, if the tubular sleeve 2216 can be easily rotated, that would indicate that the first and second tubular members, 2210 and 2228, are not fully threadably coupled and in intimate contact with the internal flange 2218 of the tubular sleeve. Furthermore, the tubular sleeve 2216 may prevent crack propagation during the radial expansion and plastic deformation of the first and second tubular members, 2210 and 2228. In this manner, failure modes such as, for example, longitudinal cracks in the end portions, 2214 and 2226, of the first and second tubular members may be limited in severity or eliminated all together. In addition, after completing the radial expansion and plastic deformation of the first and second tubular members, 2210 and 2228, the tubular sleeve 2216 may provide a fluid tight metal-to-metal seal between interior surface of the tubular sleeve 2216 and the exterior surfaces of the end

portions, 2214 and 2226, of the first and second tubular members. In this manner, fluidic materials are prevented from passing through the threaded connections, 2212 and 2224, of the first and second tubular members, 2210 and 2228, into the annulus between the first and second tubular members and the structure 2232. Furthermore, because, following the radial expansion and plastic deformation of the first and second tubular members, 2210 and 2228, the tubular sleeve 2216 may be maintained in circumferential tension and the end portions, 2214 and 2226, of the first and second tubular members, 2210 and 2228, may be maintained in circumferential compression, axial loads and/or torque loads may be transmitted through the tubular sleeve.

[00243] In several exemplary embodiments, one or more portions of the first and second tubular members, 2210 and 2228, and the tubular sleeve 2216 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00244] Referring to Fig. 23, in an exemplary embodiment, a first tubular member 210 includes an internally threaded connection 2312 at an end portion 2314. A first end of a tubular sleeve 2316 includes an internal flange 2318 and a tapered portion 2320. A second end of the sleeve 2316 includes an internal flange 2321 and a tapered portion 2322. An externally threaded connection 2324 of an end portion 2326 of a second tubular member 2328 having an annular recess 2330, is then positioned within the tubular sleeve 2316 and threadably coupled to the internally threaded connection 2312 of the end portion 2314 of the first tubular member 2310. The internal flange 2318 of the sleeve 2316 mates with and is received within the annular recess 2330.

[00245] The first tubular member 2310 includes a recess 2331. The internal flange 2321 mates with and is received within the annular recess 2331. Thus, the sleeve 2316 is coupled to and surrounds the external surfaces of the first and second tubular members 2310 and 2328.

[00246] The internally threaded connection 2312 of the end portion 2314 of the first tubular member 2310 is a box connection, and the externally threaded connection 2324 of the end portion 2326 of the second tubular member 2328 is a pin connection. In an exemplary embodiment, the internal diameter of the tubular sleeve 2316 is at least approximately .020" greater than the outside diameters of the first and second tubular members 2310 and 2328. In this manner, during the threaded coupling of the first and second tubular members 2310 and 2328, fluidic materials within the first and second tubular members may be vented from the tubular members.

[00247] As illustrated in Fig. 23, the first and second tubular members 2310 and 2328, and the tubular sleeve 2316 may then be positioned within another structure 2332 such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by

displacing and/or rotating an expansion device 2334 through and/or within the interiors of the first and second tubular members. The tapered portions 2320 and 2322, of the tubular sleeve 2316 facilitates the insertion and movement of the first and second tubular members within and through the structure 2332, and the displacement of the expansion device 2334 through the interiors of the first and second tubular members 2310 and 2328, may be from top to bottom or from bottom to top.

[00248] During the radial expansion and plastic deformation of the first and second tubular members 2310 and 2328, the tubular sleeve 2316 is also radially expanded and plastically deformed. In an exemplary embodiment, as a result, the tubular sleeve 2316 may be maintained in circumferential tension and the end portions 2314 and 2326, of the first and second tubular members 2310 and 2328, may be maintained in circumferential compression.

[00249] Sleeve 2316 increases the axial tension loading of the connection between tubular members 2310 and 2328 before and after expansion by the expansion device 2334. Sleeve 2316 may be secured to tubular members 2310 and 2328 by a heat shrink fit.

[00250] In several exemplary embodiments, one or more portions of the first and second tubular members, 2310 and 2328, and the tubular sleeve 2316 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00251] Referring to Fig. 24, in an exemplary embodiment, a first tubular member 2410 includes an internally threaded connection 2412 at an end portion 2414. A first end of a tubular sleeve 2416 includes an internal flange 2418 and a tapered portion 2420. A second end of the sleeve 2416 includes an internal flange 2421 and a tapered portion 2422. An externally threaded connection 2424 of an end portion 2426 of a second tubular member 2428 having an annular recess 2430, is then positioned within the tubular sleeve 2416 and threadably coupled to the internally threaded connection 2412 of the end portion 2414 of the first tubular member 2410. The internal flange 2418 of the sleeve 2416 mates with and is received within the annular recess 2430. The first tubular member 2410 includes a recess 2431. The internal flange 2421 mates with and is received within the annular recess 2431. Thus, the sleeve 2416 is coupled to and surrounds the external surfaces of the first and second tubular members 2410 and 2428.

[00252] The internally threaded connection 2412 of the end portion 2414 of the first tubular member 2410 is a box connection, and the externally threaded connection 2424 of the end portion 2426 of the second tubular member 2428 is a pin connection. In an exemplary embodiment, the internal diameter of the tubular sleeve 2416 is at least approximately .020" greater than the outside diameters of the first and second tubular members 2410 and 2428. In this manner, during the threaded coupling of the first and

second tubular members 2410 and 2428, fluidic materials within the first and second tubular members may be vented from the tubular members.

[00253] As illustrated in Fig. 24, the first and second tubular members 2410 and 2428, and the tubular sleeve 2416 may then be positioned within another structure 2432 such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating an expansion device 2434 through and/or within the interiors of the first and second tubular members. The tapered portions 2420 and 2422, of the tubular sleeve 2416 facilitate the insertion and movement of the first and second tubular members within and through the structure 2432, and the displacement of the expansion device 2434 through the interiors of the first and second tubular members, 2410 and 2428, may be from top to bottom or from bottom to top.

[00254] During the radial expansion and plastic deformation of the first and second tubular members, 2410 and 2428, the tubular sleeve 2416 is also radially expanded and plastically deformed. In an exemplary embodiment, as a result, the tubular sleeve 2416 may be maintained in circumferential tension and the end portions, 2414 and 2426, of the first and second tubular members, 2410 and 2428, may be maintained in circumferential compression.

[00255] The sleeve 2416 increases the axial compression and tension loading of the connection between tubular members 2410 and 2428 before and after expansion by expansion device 2424. Sleeve 2416 may be secured to tubular members 2410 and 2428 by a heat shrink fit.

[00256] In several exemplary embodiments, one or more portions of the first and second tubular members, 2410 and 2428, and the tubular sleeve 2416 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00257] Referring to Fig. 25, in an exemplary embodiment, a first tubular member 2510 includes an internally threaded connection 2512 at an end portion 2514. A first end of a tubular sleeve 2516 includes an internal flange 2518 and a relief 2520. A second end of the sleeve 2516 includes an internal flange 2521 and a relief 2522. An externally threaded connection 2524 of an end portion 2526 of a second tubular member 2528 having an annular recess 2530, is then positioned within the tubular sleeve 2516 and threadably coupled to the internally threaded connection 2512 of the end portion 2514 of the first tubular member 2510. The internal flange 2518 of the sleeve 2516 mates with and is received within the annular recess 2530. The first tubular member 2510 includes a recess 2531. The internal flange 2521 mates with and is received within the annular recess 2531. Thus, the sleeve 2516 is coupled to and surrounds the external surfaces of the first and second tubular members 2510 and 2528.

[00258] The internally threaded connection 2512 of the end portion 2514 of the first tubular member 2510 is a box connection, and the externally threaded connection 2524 of the end portion 2526 of the second tubular member 2528 is a pin connection. In an exemplary embodiment, the internal diameter of the tubular sleeve 2516 is at least approximately .020" greater than the outside diameters of the first and second tubular members 2510 and 2528. In this manner, during the threaded coupling of the first and second tubular members 2510 and 2528, fluidic materials within the first and second tubular members may be vented from the tubular members.

[00259] As illustrated in Fig. 25, the first and second tubular members 2510 and 2528, and the tubular sleeve 2516 may then be positioned within another structure 2532 such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating an expansion device 2534 through and/or within the interiors of the first and second tubular members. The reliefs 2520 and 2522 are each filled with a sacrificial material 2540 including a tapered surface 2542 and 2544, respectively. The material 2540 may be a metal or a synthetic, and is provided to facilitate the insertion and movement of the first and second tubular members 2510 and 2528, through the structure 2532. The displacement of the expansion device 2534 through the interiors of the first and second tubular members 2510 and 2528, may, for example, be from top to bottom or from bottom to top.

[00260] During the radial expansion and plastic deformation of the first and second tubular members 2510 and 2528, the tubular sleeve 2516 is also radially expanded and plastically deformed. In an exemplary embodiment, as a result, the tubular sleeve 2516 may be maintained in circumferential tension and the end portions 2514 and 2526, of the first and second tubular members, 2510 and 2528, may be maintained in circumferential compression.

[00261] The addition of the sacrificial material 2540, provided on sleeve 2516, avoids stress risers on the sleeve 2516 and the tubular member 2510. The tapered surfaces 2542 and 2544 are intended to wear or even become damaged, thus incurring such wear or damage which would otherwise be borne by sleeve 2516. Sleeve 2516 may be secured to tubular members 2510 and 2528 by a heat shrink fit.

[00262] In several exemplary embodiments, one or more portions of the first and second tubular members, 2510 and 2528, and the tubular sleeve 2516 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00263] Referring to Fig. 26, in an exemplary embodiment, a first tubular member 2610 includes an internally threaded connection 2612 at an end portion 2614. A first end of a tubular sleeve 2616 includes an internal flange 2618 and a tapered portion 2620. A

second end of the sleeve 2616 includes an internal flange 2621 and a tapered portion 2622. An externally threaded connection 2624 of an end portion 2626 of a second tubular member 2628 having an annular recess 2630, is then positioned within the tubular sleeve 2616 and threadably coupled to the internally threaded connection 2612 of the end portion 2614 of the first tubular member 2610. The internal flange 2618 of the sleeve 2616 mates with and is received within the annular recess 2630.

[00264] The first tubular member 2610 includes a recess 2631. The internal flange 2621 mates with and is received within the annular recess 2631. Thus, the sleeve 2616 is coupled to and surrounds the external surfaces of the first and second tubular members 2610 and 2628.

[00265] The internally threaded connection 2612 of the end portion 2614 of the first tubular member 2610 is a box connection, and the externally threaded connection 2624 of the end portion 2626 of the second tubular member 2628 is a pin connection. In an exemplary embodiment, the internal diameter of the tubular sleeve 2616 is at least approximately .020" greater than the outside diameters of the first and second tubular members 2610 and 2628. In this manner, during the threaded coupling of the first and second tubular members 2610 and 2628, fluidic materials within the first and second tubular members may be vented from the tubular members.

[00266] As illustrated in Fig. 26, the first and second tubular members 2610 and 2628, and the tubular sleeve 2616 may then be positioned within another structure 2632 such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating an expansion device 2634 through and/or within the interiors of the first and second tubular members. The tapered portions 2620 and 2622, of the tubular sleeve 2616 facilitates the insertion and movement of the first and second tubular members within and through the structure 2632, and the displacement of the expansion device 2634 through the interiors of the first and second tubular members 2610 and 2628, may, for example, be from top to bottom or from bottom to top.

[00267] During the radial expansion and plastic deformation of the first and second tubular members 2610 and 2628, the tubular sleeve 2616 is also radially expanded and plastically deformed. In an exemplary embodiment, as a result, the tubular sleeve 2616 may be maintained in circumferential tension and the end portions 2614 and 2626, of the first and second tubular members 2610 and 2628, may be maintained in circumferential compression.

[00268] Sleeve 2616 is covered by a thin walled cylinder of sacrificial material 2640. Spaces 2623 and 2624, adjacent tapered portions 2620 and 2622, respectively, are also filled with an excess of the sacrificial material 2640. The material may be a metal or a synthetic, and is provided to facilitate the insertion and movement of the first and second tubular members 2610 and 2628, through the structure 2632.

[00269] The addition of the sacrificial material 2640, provided on sleeve 2616, avoids stress risers on the sleeve 2616 and the tubular member 2610. The excess of the sacrificial material 2640 adjacent tapered portions 2620 and 2622 are intended to wear or even become damaged, thus incurring such wear or damage which would otherwise be borne by sleeve 2616. Sleeve 2616 may be secured to tubular members 2610 and 2628 by a heat shrink fit.

[00270] In several exemplary embodiments, one or more portions of the first and second tubular members, 2610 and 2628, and the tubular sleeve 2616 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00271] Referring to Fig. 27, in an exemplary embodiment, a first tubular member 2710 includes an internally threaded connection 2712 at an end portion 2714. A first end of a tubular sleeve 2716 includes an internal flange 2718 and a tapered portion 2720. A second end of the sleeve 2716 includes an internal flange 2721 and a tapered portion 2722. An externally threaded connection 2724 of an end portion 2726 of a second tubular member 2728 having an annular recess 2730, is then positioned within the tubular sleeve 2716 and threadably coupled to the internally threaded connection 2712 of the end portion 2714 of the first tubular member 2710. The internal flange 2718 of the sleeve 2716 mates with and is received within the annular recess 2730.

[00272] The first tubular member 2710 includes a recess 2731. The internal flange 2721 mates with and is received within the annular recess 2731. Thus, the sleeve 2716 is coupled to and surrounds the external surfaces of the first and second tubular members 2710 and 2728.

[00273] The internally threaded connection 2712 of the end portion 2714 of the first tubular member 2710 is a box connection, and the externally threaded connection 2724 of the end portion 2726 of the second tubular member 2728 is a pin connection. In an exemplary embodiment, the internal diameter of the tubular sleeve 2716 is at least approximately .020" greater than the outside diameters of the first and second tubular members 2710 and 2728. In this manner, during the threaded coupling of the first and second tubular members 2710 and 2728, fluidic materials within the first and second tubular members may be vented from the tubular members.

[00274] As illustrated in Fig. 27, the first and second tubular members 2710 and 2728, and the tubular sleeve 2716 may then be positioned within another structure 2732 such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating an expansion device 2734 through and/or within the interiors of the first and second tubular members. The tapered portions 2720 and 2722, of the tubular sleeve 2716 facilitates the insertion and movement of the first and second tubular members

within and through the structure 2732, and the displacement of the expansion device 2734 through the interiors of the first and second tubular members 2710 and 2728, may be from top to bottom or from bottom to top.

[00275] During the radial expansion and plastic deformation of the first and second tubular members 2710 and 2728, the tubular sleeve 2716 is also radially expanded and plastically deformed. In an exemplary embodiment, as a result, the tubular sleeve 2716 may be maintained in circumferential tension and the end portions 2714 and 2726, of the first and second tubular members 2710 and 2728, may be maintained in circumferential compression.

[00276] Sleeve 2716 has a variable thickness due to one or more reduced thickness portions 2790 and/or increased thickness portions 2792.

[00277] Varying the thickness of sleeve 2716 provides the ability to control or induce stresses at selected positions along the length of sleeve 2716 and the end portions 2724 and 2726. Sleeve 2716 may be secured to tubular members 2710 and 2728 by a heat shrink fit.

[00278] In several exemplary embodiments, one or more portions of the first and second tubular members, 2710 and 2728, and the tubular sleeve 2716 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00279] Referring to Fig. 28, in an alternative embodiment, instead of varying the thickness of sleeve 2716, the same result described above with reference to Fig. 27, may be achieved by adding a member 2740 which may be coiled onto the grooves 2739 formed in sleeve 2716, thus varying the thickness along the length of sleeve 2716.

[00280] Referring to Fig. 29, in an exemplary embodiment, a first tubular member 2910 includes an internally threaded connection 2912 and an internal annular recess 2914 at an end portion 2916. A first end of a tubular sleeve 2918 includes an internal flange 2920, and a second end of the sleeve 2916 mates with and receives the end portion 2916 of the first tubular member 2910. An externally threaded connection 2922 of an end portion 2924 of a second tubular member 2926 having an annular recess 2928, is then positioned within the tubular sleeve 2918 and threadably coupled to the internally threaded connection 2912 of the end portion 2916 of the first tubular member 2910. The internal flange 2920 of the sleeve 2918 mates with and is received within the annular recess 2928. A sealing element 2930 is received within the internal annular recess 2914 of the end portion 2916 of the first tubular member 2910.

[00281] The internally threaded connection 2912 of the end portion 2916 of the first tubular member 2910 is a box connection, and the externally threaded connection 2922 of the end portion 2924 of the second tubular member 2926 is a pin connection. In an exemplary embodiment, the internal diameter of the tubular sleeve 2918 is at least

approximately .020" greater than the outside diameters of the first tubular member 2910. In this manner, during the threaded coupling of the first and second tubular members 2910 and 2926, fluidic materials within the first and second tubular members may be vented from the tubular members.

[00282] The first and second tubular members 2910 and 2926, and the tubular sleeve 2918 may be positioned within another structure such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating an expansion device through and/or within the interiors of the first and second tubular members.

[00283] During the radial expansion and plastic deformation of the first and second tubular members 2910 and 2926, the tubular sleeve 2918 is also radially expanded and plastically deformed. In an exemplary embodiment, as a result, the tubular sleeve 2918 may be maintained in circumferential tension and the end portions 2916 and 2924, of the first and second tubular members 2910 and 2926, respectively, may be maintained in circumferential compression.

[00284] In an exemplary embodiment, before, during, and after the radial expansion and plastic deformation of the first and second tubular members 2910 and 2926, and the tubular sleeve 2918, the sealing element 2930 seals the interface between the first and second tubular members. In an exemplary embodiment, during and after the radial expansion and plastic deformation of the first and second tubular members 2910 and 2926, and the tubular sleeve 2918, a metal to metal seal is formed between at least one of: the first and second tubular members 2910 and 2926, the first tubular member and the tubular sleeve 2918, and/or the second tubular member and the tubular sleeve. In an exemplary embodiment, the metal to metal seal is both fluid tight and gas tight.

[00285] In several exemplary embodiments, one or more portions of the first and second tubular members, 2910 and 2926, the tubular sleeve 2918, and the sealing element 2930 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00286] Referring to Fig. 30a, in an exemplary embodiment, a first tubular member 3010 includes internally threaded connections 3012a and 3012b, spaced apart by a cylindrical internal surface 3014, at an end portion 3016. Externally threaded connections 3018a and 3018b, spaced apart by a cylindrical external surface 3020, of an end portion 3022 of a second tubular member 3024 are threadably coupled to the internally threaded connections, 3012a and 3012b, respectively, of the end portion 3016 of the first tubular member 3010. A sealing element 3026 is received within an annulus defined between the internal cylindrical surface 3014 of the first tubular member 3010 and the external cylindrical surface 3020 of the second tubular member 3024.

[00287] The internally threaded connections, 3012a and 3012b, of the end portion 3016 of the first tubular member 3010 are box connections, and the externally threaded connections, 3018a and 3018b, of the end portion 3022 of the second tubular member 3024 are pin connections. In an exemplary embodiment, the sealing element 3026 is an elastomeric and/or metallic sealing element.

[00288] The first and second tubular members 3010 and 3024 may be positioned within another structure such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating an expansion device through and/or within the interiors of the first and second tubular members.

[00289] In an exemplary embodiment, before, during, and after the radial expansion and plastic deformation of the first and second tubular members 3010 and 3024, the sealing element 3026 seals the interface between the first and second tubular members. In an exemplary embodiment, before, during and/or after the radial expansion and plastic deformation of the first and second tubular members 3010 and 3024, a metal to metal seal is formed between at least one of: the first and second tubular members 3010 and 3024, the first tubular member and the sealing element 3026, and/or the second tubular member and the sealing element. In an exemplary embodiment, the metal to metal seal is both fluid tight and gas tight.

[00290] In an alternative embodiment, the sealing element 3026 is omitted, and during and/or after the radial expansion and plastic deformation of the first and second tubular members 3010 and 3024, a metal to metal seal is formed between the first and second tubular members.

[00291] In several exemplary embodiments, one or more portions of the first and second tubular members, 3010 and 3024, the sealing element 3026 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00292] Referring to Fig. 30b, in an exemplary embodiment, a first tubular member 3030 includes internally threaded connections 3032a and 3032b, spaced apart by an undulating approximately cylindrical internal surface 3034, at an end portion 3036. Externally threaded connections 3038a and 3038b, spaced apart by a cylindrical external surface 3040, of an end portion 3042 of a second tubular member 3044 are threadably coupled to the internally threaded connections, 3032a and 3032b, respectively, of the end portion 3036 of the first tubular member 3030. A sealing element 3046 is received within an annulus defined between the undulating approximately cylindrical internal surface 3034 of the first tubular member 3030 and the external cylindrical surface 3040 of the second tubular member 3044.

[00293] The internally threaded connections, 3032a and 3032b, of the end portion 3036 of the first tubular member 3030 are box connections, and the externally threaded connections, 3038a and 3038b, of the end portion 3042 of the second tubular member 3044 are pin connections. In an exemplary embodiment, the sealing element 3046 is an elastomeric and/or metallic sealing element.

[00294] The first and second tubular members 3030 and 3044 may be positioned within another structure such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating an expansion device through and/or within the interiors of the first and second tubular members.

[00295] In an exemplary embodiment, before, during, and after the radial expansion and plastic deformation of the first and second tubular members 3030 and 3044, the sealing element 3046 seals the interface between the first and second tubular members. In an exemplary embodiment, before, during and/or after the radial expansion and plastic deformation of the first and second tubular members 3030 and 3044, a metal to metal seal is formed between at least one of: the first and second tubular members 3030 and 3044, the first tubular member and the sealing element 3046, and/or the second tubular member and the sealing element. In an exemplary embodiment, the metal to metal seal is both fluid tight and gas tight.

[00296] In an alternative embodiment, the sealing element 3046 is omitted, and during and/or after the radial expansion and plastic deformation of the first and second tubular members 3030 and 3044, a metal to metal seal is formed between the first and second tubular members.

[00297] In several exemplary embodiments, one or more portions of the first and second tubular members, 3030 and 3044, the sealing element 3046 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00298] Referring to Fig. 30c, in an exemplary embodiment, a first tubular member 3050 includes internally threaded connections 3052a and 3052b, spaced apart by a cylindrical internal surface 3054 including one or more square grooves 3056, at an end portion 3058. Externally threaded connections 3060a and 3060b, spaced apart by a cylindrical external surface 3062 including one or more square grooves 3064, of an end portion 3066 of a second tubular member 3068 are threadably coupled to the internally threaded connections, 3052a and 3052b, respectively, of the end portion 3058 of the first tubular member 3050. A sealing element 3070 is received within an annulus defined between the cylindrical internal surface 3054 of the first tubular member 3050 and the external cylindrical surface 3062 of the second tubular member 3068.

[00299] The internally threaded connections, 3052a and 3052b, of the end portion 3058 of the first tubular member 3050 are box connections, and the externally threaded connections, 3060a and 3060b, of the end portion 3066 of the second tubular member 3068 are pin connections. In an exemplary embodiment, the sealing element 3070 is an elastomeric and/or metallic sealing element.

[00300] The first and second tubular members 3050 and 3068 may be positioned within another structure such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating an expansion device through and/or within the interiors of the first and second tubular members.

[00301] In an exemplary embodiment, before, during, and after the radial expansion and plastic deformation of the first and second tubular members 3050 and 3068, the sealing element 3070 seals the interface between the first and second tubular members. In an exemplary embodiment, before, during and/or after the radial expansion and plastic deformation of the first and second tubular members, 3050 and 3068, a metal to metal seal is formed between at least one of: the first and second tubular members, the first tubular member and the sealing element 3070, and/or the second tubular member and the sealing element. In an exemplary embodiment, the metal to metal seal is both fluid tight and gas tight.

[00302] In an alternative embodiment, the sealing element 3070 is omitted, and during and/or after the radial expansion and plastic deformation of the first and second tubular members 950 and 968, a metal to metal seal is formed between the first and second tubular members.

[00303] In several exemplary embodiments, one or more portions of the first and second tubular members, 3050 and 3068, the sealing element 3070 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00304] Referring to Fig. 31, in an exemplary embodiment, a first tubular member 3110 includes internally threaded connections, 3112a and 3112b, spaced apart by a non-threaded internal surface 3114, at an end portion 3116. Externally threaded connections, 3118a and 3118b, spaced apart by a non-threaded external surface 3120, of an end portion 3122 of a second tubular member 3124 are threadably coupled to the internally threaded connections, 3112a and 3112b, respectively, of the end portion 3122 of the first tubular member 3124.

[00305] First, second, and/or third tubular sleeves, 3126, 3128, and 3130, are coupled the external surface of the first tubular member 3110 in opposing relation to the threaded connection formed by the internal and external threads, 3112a and 3118a, the interface

between the non-threaded surfaces, 3114 and 3120, and the threaded connection formed by the internal and external threads, 3112b and 3118b, respectively.

[00306] The internally threaded connections, 3112a and 3112b, of the end portion 3116 of the first tubular member 3110 are box connections, and the externally threaded connections, 3118a and 3118b, of the end portion 3122 of the second tubular member 3124 are pin connections.

[00307] The first and second tubular members 3110 and 3124, and the tubular sleeves 3126, 3128, and/or 3130, may then be positioned within another structure 3132 such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating an expansion device 3134 through and/or within the interiors of the first and second tubular members.

[00308] During the radial expansion and plastic deformation of the first and second tubular members 3110 and 3124, the tubular sleeves 3126, 3128 and/or 3130 are also radially expanded and plastically deformed. In an exemplary embodiment, as a result, the tubular sleeves 3126, 3128, and/or 3130 are maintained in circumferential tension and the end portions 3116 and 3122, of the first and second tubular members 3110 and 3124, may be maintained in circumferential compression.

[00309] The sleeves 3126, 3128, and/or 3130 may, for example, be secured to the first tubular member 3110 by a heat shrink fit.

[00310] In several exemplary embodiments, one or more portions of the first and second tubular members, 3110 and 3124, and the sleeves, 3126, 3128, and 3130, have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00311] Referring to Fig. 32a, in an exemplary embodiment, a first tubular member 3210 includes an internally threaded connection 3212 at an end portion 3214. An externally threaded connection 3216 of an end portion 3218 of a second tubular member 3220 are threadably coupled to the internally threaded connection 3212 of the end portion 3214 of the first tubular member 3210.

[00312] The internally threaded connection 3212 of the end portion 3214 of the first tubular member 3210 is a box connection, and the externally threaded connection 3216 of the end portion 3218 of the second tubular member 3220 is a pin connection.

[00313] A tubular sleeve 3222 including internal flanges 3224 and 3226 is positioned proximate and surrounding the end portion 3214 of the first tubular member 3210. As illustrated in Fig. 32b, the tubular sleeve 3222 is then forced into engagement with the external surface of the end portion 3214 of the first tubular member 3210 in a conventional manner. As a result, the end portions, 3214 and 3218, of the first and second tubular members, 3210 and 3220, are upset in an undulating fashion.

[00314] The first and second tubular members 3210 and 3220, and the tubular sleeve 3222, may then be positioned within another structure such as, for example, a wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating an expansion device through and/or within the interiors of the first and second tubular members.

[00315] During the radial expansion and plastic deformation of the first and second tubular members 3210 and 3220, the tubular sleeve 3222 is also radially expanded and plastically deformed. In an exemplary embodiment, as a result, the tubular sleeve 3222 is maintained in circumferential tension and the end portions 3214 and 3218, of the first and second tubular members 3210 and 3220, may be maintained in circumferential compression.

[00316] In several exemplary embodiments, one or more portions of the first and second tubular members, 3210 and 3220, and the sleeve 3222 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00317] Referring to Fig. 33, in an exemplary embodiment, a first tubular member 3310 includes an internally threaded connection 3312 and an annular projection 3314 at an end portion 3316.

[00318] A first end of a tubular sleeve 3318 that includes an internal flange 3320 having a tapered portion 3322 and an annular recess 3324 for receiving the annular projection 3314 of the first tubular member 3310, and a second end that includes a tapered portion 3326, is then mounted upon and receives the end portion 3316 of the first tubular member 3310.

[00319] In an exemplary embodiment, the end portion 3316 of the first tubular member 3310 abuts one side of the internal flange 3320 of the tubular sleeve 3318 and the annular projection 3314 of the end portion of the first tubular member mates with and is received within the annular recess 3324 of the internal flange of the tubular sleeve, and the internal diameter of the internal flange 3320 of the tubular sleeve 3318 is substantially equal to or greater than the maximum internal diameter of the internally threaded connection 3312 of the end portion 3316 of the first tubular member 3310. An externally threaded connection 3326 of an end portion 3328 of a second tubular member 3330 having an annular recess 3332 is then positioned within the tubular sleeve 3318 and threadably coupled to the internally threaded connection 3312 of the end portion 3316 of the first tubular member 3310. In an exemplary embodiment, the internal flange 3332 of the tubular sleeve 3318 mates with and is received within the annular recess 3332 of the end portion 3328 of the second tubular member 3330. Thus, the tubular sleeve 3318 is coupled to and surrounds the external surfaces of the first and second tubular members, 3310 and 3328.

[00320] The internally threaded connection 3312 of the end portion 3316 of the first tubular member 3310 is a box connection, and the externally threaded connection 3326 of

the end portion 3328 of the second tubular member 3330 is a pin connection. In an exemplary embodiment, the internal diameter of the tubular sleeve 3318 is at least approximately .020" greater than the outside diameters of the first and second tubular members, 3310 and 3330. In this manner, during the threaded coupling of the first and second tubular members, 3310 and 3330, fluidic materials within the first and second tubular members may be vented from the tubular members.

[00321] As illustrated in Fig. 33, the first and second tubular members, 3310 and 3330, and the tubular sleeve 3318 may be positioned within another structure 3334 such as, for example, a cased or uncased wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating a conventional expansion device 3336 within and/or through the interiors of the first and second tubular members. The tapered portions, 3322 and 3326, of the tubular sleeve 3318 facilitate the insertion and movement of the first and second tubular members within and through the structure 3334, and the movement of the expansion device 3336 through the interiors of the first and second tubular members, 3310 and 3330, may, for example, be from top to bottom or from bottom to top.

[00322] During the radial expansion and plastic deformation of the first and second tubular members, 3310 and 3330, the tubular sleeve 3318 is also radially expanded and plastically deformed. As a result, the tubular sleeve 3318 may be maintained in circumferential tension and the end portions, 3316 and 3328, of the first and second tubular members, 3310 and 3330, may be maintained in circumferential compression.

[00323] Sleeve 3316 increases the axial compression loading of the connection between tubular members 3310 and 3330 before and after expansion by the expansion device 3336. Sleeve 3316 may be secured to tubular members 3310 and 3330, for example, by a heat shrink fit.

[00324] In several alternative embodiments, the first and second tubular members, 3310 and 3330, are radially expanded and plastically deformed using other conventional methods for radially expanding and plastically deforming tubular members such as, for example, internal pressurization, hydroforming, and/or roller expansion devices and/or any one or combination of the conventional commercially available expansion products and services available from Baker Hughes, Weatherford International, and/or Enventure Global Technology L.L.C.

[00325] The use of the tubular sleeve 3318 during (a) the coupling of the first tubular member 3310 to the second tubular member 3330, (b) the placement of the first and second tubular members in the structure 3334, and (c) the radial expansion and plastic deformation of the first and second tubular members provides a number of significant benefits. For example, the tubular sleeve 3318 protects the exterior surfaces of the end portions, 3316 and 3328, of the first and second tubular members, 3310 and 3330, during handling and

insertion of the tubular members within the structure 3334. In this manner, damage to the exterior surfaces of the end portions, 3316 and 3328, of the first and second tubular members, 3310 and 3330, is avoided that could otherwise result in stress concentrations that could cause a catastrophic failure during subsequent radial expansion operations. Furthermore, the tubular sleeve 3318 provides an alignment guide that facilitates the insertion and threaded coupling of the second tubular member 3330 to the first tubular member 3310. In this manner, misalignment that could result in damage to the threaded connections, 3312 and 3326, of the first and second tubular members, 3310 and 3330, may be avoided. In addition, during the relative rotation of the second tubular member with respect to the first tubular member, required during the threaded coupling of the first and second tubular members, the tubular sleeve 3318 provides an indication of to what degree the first and second tubular members are threadably coupled. For example, if the tubular sleeve 3318 can be easily rotated, that would indicate that the first and second tubular members, 3310 and 3330, are not fully threadably coupled and in intimate contact with the internal flange 3320 of the tubular sleeve. Furthermore, the tubular sleeve 3318 may prevent crack propagation during the radial expansion and plastic deformation of the first and second tubular members, 3310 and 3330. In this manner, failure modes such as, for example, longitudinal cracks in the end portions, 3316 and 3328, of the first and second tubular members may be limited in severity or eliminated all together. In addition, after completing the radial expansion and plastic deformation of the first and second tubular members, 3310 and 3330, the tubular sleeve 3318 may provide a fluid tight metal-to-metal seal between interior surface of the tubular sleeve 3318 and the exterior surfaces of the end portions, 3316 and 3328, of the first and second tubular members. In this manner, fluidic materials are prevented from passing through the threaded connections, 3312 and 3326, of the first and second tubular members, 3310 and 3330, into the annulus between the first and second tubular members and the structure 3334. Furthermore, because, following the radial expansion and plastic deformation of the first and second tubular members, 3310 and 3330, the tubular sleeve 3318 may be maintained in circumferential tension and the end portions, 3316 and 3328, of the first and second tubular members, 3310 and 3330, may be maintained in circumferential compression, axial loads and/or torque loads may be transmitted through the tubular sleeve.

[00326] In several exemplary embodiments, one or more portions of the first and second tubular members, 3310 and 3330, and the sleeve 3318 have one or more of the material properties of one or more of the tubular members 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204.

[00327] Referring to Figs. 34a, 34b, and 34c, in an exemplary embodiment, a first tubular member 3410 includes an internally threaded connection 1312 and one or more

external grooves 3414 at an end portion 3416.

[00328] A first end of a tubular sleeve 3418 that includes an internal flange 3420 and a tapered portion 3422, a second end that includes a tapered portion 3424, and an intermediate portion that includes one or more longitudinally aligned openings 3426, is then mounted upon and receives the end portion 3416 of the first tubular member 3410.

[00329] In an exemplary embodiment, the end portion 3416 of the first tubular member 3410 abuts one side of the internal flange 3420 of the tubular sleeve 3418, and the internal diameter of the internal flange 3420 of the tubular sleeve 3416 is substantially equal to or greater than the maximum internal diameter of the internally threaded connection 3412 of the end portion 3416 of the first tubular member 3410. An externally threaded connection 3428 of an end portion 3430 of a second tubular member 3432 that includes one or more internal grooves 3434 is then positioned within the tubular sleeve 3418 and threadably coupled to the internally threaded connection 3412 of the end portion 3416 of the first tubular member 3410. In an exemplary embodiment, the internal flange 3420 of the tubular sleeve 3418 mates with and is received within an annular recess 3436 defined in the end portion 3430 of the second tubular member 3432. Thus, the tubular sleeve 3418 is coupled to and surrounds the external surfaces of the first and second tubular members, 3410 and 3432.

[00330] The first and second tubular members, 3410 and 3432, and the tubular sleeve 3418 may be positioned within another structure such as, for example, a cased or uncased wellbore, and radially expanded and plastically deformed, for example, by displacing and/or rotating a conventional expansion device within and/or through the interiors of the first and second tubular members. The tapered portions, 3422 and 3424, of the tubular sleeve 3418 facilitate the insertion and movement of the first and second tubular members within and through the structure, and the movement of the expansion device through the interiors of the first and second tubular members, 3410 and 3432, may be from top to bottom or from bottom to top.

[00331] During the radial expansion and plastic deformation of the first and second tubular members, 3410 and 3432, the tubular sleeve 3418 is also radially expanded and plastically deformed. As a result, the tubular sleeve 3418 may be maintained in circumferential tension and the end portions, 3416 and 3430, of the first and second tubular members, 3410 and 3432, may be maintained in circumferential compression.

[00332] Sleeve 3416 increases the axial compression loading of the connection between tubular members 3410 and 3432 before and after expansion by the expansion device. The sleeve 3418 may be secured to tubular members 3410 and 3432, for example, by a heat shrink fit.

[00333] During the radial expansion and plastic deformation of the first and second tubular members, 3410 and 3432, the grooves 3414 and/or 3434 and/or the openings 3426

provide stress concentrations that in turn apply added stress forces to the mating threads of the threaded connections, 3412 and 3428. As a result, during and after the radial expansion and plastic deformation of the first and second tubular members, 3410 and 3432, the mating threads of the threaded connections, 3412 and 3428, are maintained in metal to metal contact thereby providing a fluid and gas tight connection. In an exemplary embodiment, the orientations of the grooves 3414 and/or 3434 and the openings 3426 are orthogonal to one another. In an exemplary embodiment, the grooves 3414 and/or 3434 are helical grooves.

[00334] In several alternative embodiments, the first and second tubular members, 3410 and 3432, are radially expanded and plastically deformed using other conventional methods for radially expanding and plastically deforming tubular members such as, for example, internal pressurization, hydroforming, and/or roller expansion devices and/or any one or combination of the conventional commercially available expansion products and services available from Baker Hughes, Weatherford International, and/or Enventure Global Technology L.L.C.

[00335] The use of the tubular sleeve 3418 during (a) the coupling of the first tubular member 3410 to the second tubular member 3432, (b) the placement of the first and second tubular members in the structure, and (c) the radial expansion and plastic deformation of the first and second tubular members provides a number of significant benefits. For example, the tubular sleeve 3418 protects the exterior surfaces of the end portions, 3416 and 3430, of the first and second tubular members, 3410 and 3432, during handling and insertion of the tubular members within the structure. In this manner, damage to the exterior surfaces of the end portions, 3416 and 3430, of the first and second tubular members, 3410 and 3432, is avoided that could otherwise result in stress concentrations that could cause a catastrophic failure during subsequent radial expansion operations. Furthermore, the tubular sleeve 3418 provides an alignment guide that facilitates the insertion and threaded coupling of the second tubular member 3432 to the first tubular member 3410. In this manner, misalignment that could result in damage to the threaded connections, 3412 and 3428, of the first and second tubular members, 3410 and 3432, may be avoided. In addition, during the relative rotation of the second tubular member with respect to the first tubular member, required during the threaded coupling of the first and second tubular members, the tubular sleeve 3416 provides an indication of to what degree the first and second tubular members are threadably coupled. For example, if the tubular sleeve 3418 can be easily rotated, that would indicate that the first and second tubular members, 3410 and 3432, are not fully threadably coupled and in intimate contact with the internal flange 3420 of the tubular sleeve. Furthermore, the tubular sleeve 3418 may prevent crack propagation during the radial expansion and plastic deformation of the first and second tubular members, 3410 and 3432. In this manner, failure modes such as, for example, longitudinal cracks in the end

portions, 3416 and 3430, of the first and second tubular members may be limited in severity or eliminated all together. In addition, after completing the radial expansion and plastic deformation of the first and second tubular members, 3410 and 3432, the tubular sleeve 3418 may provide a fluid and gas tight metal-to-metal seal between interior surface of the tubular sleeve 3418 and the exterior surfaces of the end portions, 3416 and 3430, of the first and second tubular members. In this manner, fluidic materials are prevented from passing through the threaded connections, 3412 and 3430, of the first and second tubular members, 3410 and 3432, into the annulus between the first and second tubular members and the structure. Furthermore, because, following the radial expansion and plastic deformation of the first and second tubular members, 3410 and 3432, the tubular sleeve 3418 may be maintained in circumferential tension and the end portions, 3416 and 3430, of the first and second tubular members, 3410 and 3432, may be maintained in circumferential compression, axial loads and/or torque loads may be transmitted through the tubular sleeve.

[00336] In several exemplary embodiments, the first and second tubular members described above with reference to Figs. 1 to 34c are radially expanded and plastically deformed using the expansion device in a conventional manner and/or using one or more of the methods and apparatus disclosed in one or more of the following: The present application is related to the following: (1) U.S. patent application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, (4) U.S. patent application serial no. 09/440,338, attorney docket no. 25791.9.02, filed on 11/15/1999, (5) U.S. patent application serial no. 09/523,460, attorney docket no. 25791.11.02, filed on 3/10/2000, (6) U.S. patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, (7) U.S. patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, (8) U.S. patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, (9) U.S. patent application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, (10) PCT patent application serial no. PCT/US00/18635, attorney docket no. 25791.25.02, filed on 7/9/2000, (11) U.S. provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (12) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (13) U.S. provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (14) U.S. provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (15) U.S. provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (16) U.S. provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (17) U.S. provisional patent application serial no.

60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (18) U.S. provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (19) U.S. provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (20) U.S. provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (21) U.S. provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (22) U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001, (23) U.S. provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001, (24) U.S, provisional patent application serial no. 60/259,486, attorney docket no. 25791.52, filed on 1/3/2001, (25) U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001, (26) U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001, (27) U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001, (28) U.S. provisional patent application serial no. 60/3318,386, attorney docket no. 25791.67.02, filed on 9/10/2001, (29) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, (30) U.S. utility patent application serial no. 10/016,467, attorney docket no. 25791.70, filed on December 10, 2001, (31) U.S. provisional patent application serial no. 60/343,674, attorney docket no. 25791.68, filed on 12/27/2001; and (32) U.S. provisional patent application serial no. 60/346,309, attorney docket no. 25791.92, filed on 01/07/02, the disclosures of which are incorporated herein by reference.

[00337] Referring to Fig. 35a an exemplary embodiment of an expandable tubular member 3500 includes a first tubular region 3502 and a second tubular portion 3504. In an exemplary embodiment, the material properties of the first and second tubular regions, 3502 and 3504, are different. In an exemplary embodiment, the yield points of the first and second tubular regions, 3502 and 3504, are different. In an exemplary embodiment, the yield point of the first tubular region 3502 is less than the yield point of the second tubular region 3504. In several exemplary embodiments, one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202 and/or 204 incorporate the tubular member 3500.

[00338] Referring to Fig. 35b, in an exemplary embodiment, the yield point within the first and second tubular regions, 3502a and 3502b, of the expandable tubular member 3502 vary as a function of the radial position within the expandable tubular member. In an exemplary embodiment, the yield point increases as a function of the radial position within the expandable tubular member 3502. In an exemplary embodiment, the relationship between the yield point and the radial position within the expandable tubular member 3502 is a linear relationship. In an exemplary embodiment, the relationship between the yield point and the radial position within the expandable tubular member 3502 is a non-linear

relationship. In an exemplary embodiment, the yield point increases at different rates within the first and second tubular regions, 3502a and 3502b, as a function of the radial position within the expandable tubular member 3502. In an exemplary embodiment, the functional relationship, and value, of the yield points within the first and second tubular regions, 3502a and 3502b, of the expandable tubular member 3502 are modified by the radial expansion and plastic deformation of the expandable tubular member.

[00339] In several exemplary embodiments, one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202, 204 and/or 3502, prior to a radial expansion and plastic deformation, include a microstructure that is a combination of a hard phase, such as martensite, a soft phase, such as ferrite, and a transitionary phase, such as retained austentite. In this manner, the hard phase provides high strength, the soft phase provides ductility, and the transitionary phase transitions to a hard phase, such as martensite, during a radial expansion and plastic deformation. Furthermore, in this manner, the yield point of the tubular member increases as a result of the radial expansion and plastic deformation. Further, in this manner, the tubular member is ductile, prior to the radial expansion and plastic deformation, thereby facilitating the radial expansion and plastic deformation. In an exemplary embodiment, the composition of a dual-phase expandable tubular member includes (weight percentages): about 0.1% C, 1.2% Mn, and 0.3% Si.

[00340] In an exemplary experimental embodiment, as illustrated in Figs. 36a-36c, one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202, 204 and/or 3502 are processed in accordance with a method 3600, in which, in step 3602, an expandable tubular member 3602a is provided that is a steel alloy having following material composition (by weight percentage): 0.065% C, 1.44% Mn, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.05% V, 0.01%Mo, 0.01% Nb, and 0.01% Ti. In an exemplary experimental embodiment, the expandable tubular member 3602a provided in step 3602 has a yield strength of 45 ksi, and a tensile strength of 69 ksi.

[00341] In an exemplary experimental embodiment, as illustrated in Fig. 36b, in step 3602, the expandable tubular member 3602a includes a microstructure that includes martensite, pearlite, and V, Ni, and/or Ti carbides.

[00342] In an exemplary embodiment, the expandable tubular member 3602a is then heated at a temperature of 790 °C for about 10 minutes in step 3604.

[00343] In an exemplary embodiment, the expandable tubular member 3602a is then quenched in water in step 3606.

[00344] In an exemplary experimental embodiment, as illustrated in Fig. 36c, following the completion of step 3606, the expandable tubular member 3602a includes a microstructure that includes new ferrite, grain pearlite, martensite, and ferrite. In an

exemplary experimental embodiment, following the completion of step 3606, the expandable tubular member 3602a has a yield strength of 67 ksi, and a tensile strength of 95 ksi.

[00345] In an exemplary embodiment, the expandable tubular member 3602a is then radially expanded and plastically deformed using one or more of the methods and apparatus described above. In an exemplary embodiment, following the radial expansion and plastic deformation of the expandable tubular member 3602a, the yield strength of the expandable tubular member is about 95 ksi.

[00346] In an exemplary experimental embodiment, as illustrated in Figs. 37a-37c, one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202, 204 and/or 3502 are processed in accordance with a method 3700, in which, in step 3702, an expandable tubular member 3702a is provided that is a steel alloy having following material composition (by weight percentage): 0.18% C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.04% V, 0.01%Mo, 0.03% Nb, and 0.01% Ti. In an exemplary experimental embodiment, the expandable tubular member 3702a provided in step 3702 has a yield strength of 60 ksi, and a tensile strength of 80 ksi.

[00347] In an exemplary experimental embodiment, as illustrated in Fig. 37b, in step 3702, the expandable tubular member 3702a includes a microstructure that includes pearlite and pearlite striation.

[00348] In an exemplary embodiment, the expandable tubular member 3702a is then heated at a temperature of 790 °C for about 10 minutes in step 3704.

[00349] In an exemplary embodiment, the expandable tubular member 3702a is then quenched in water in step 3706.

[00350] In an exemplary experimental embodiment, as illustrated in Fig. 37c, following the completion of step 3706, the expandable tubular member 3702a includes a microstructure that includes ferrite, martensite, and bainite. In an exemplary experimental embodiment, following the completion of step 3706, the expandable tubular member 3702a has a yield strength of 82 ksi, and a tensile strength of 130 ksi.

[00351] In an exemplary embodiment, the expandable tubular member 3702a is then radially expanded and plastically deformed using one or more of the methods and apparatus described above. In an exemplary embodiment, following the radial expansion and plastic deformation of the expandable tubular member 3702a, the yield strength of the expandable tubular member is about 130 ksi.

[00352] In an exemplary experimental embodiment, as illustrated in Figs. 38a-38c, one or more of the expandable tubular members, 12, 14, 24, 26, 102, 104, 106, 108, 202, 204 and/or 3502 are processed in accordance with a method 3800, in which, in step 3802, an expandable tubular member 3802a is provided that is a steel alloy having following material composition (by weight percentage): 0.08% C, 0.82% Mn, 0.006% P, 0.003% S,

0.30% Si, 0.06% Cu, 0.05% Ni, 0.05% Cr, 0.03% V, 0.03%Mo, 0.01% Nb, and 0.01% Ti. In an exemplary experimental embodiment, the expandable tubular member 3802a provided in step 3802 has a yield strength of 56 ksi, and a tensile strength of 75 ksi.

[00353] In an exemplary experimental embodiment, as illustrated in Fig. 38b, in step 3802, the expandable tubular member 3802a includes a microstructure that includes grain pearlite, widmanstatten martensite and carbides of V, Ni, and/or Ti.

[00354] In an exemplary embodiment, the expandable tubular member 3802a is then heated at a temperature of 790 °C for about 10 minutes in step 3804.

[00355] In an exemplary embodiment, the expandable tubular member 3802a is then quenched in water in step 3806.

[00356] In an exemplary experimental embodiment, as illustrated in Fig. 38c, following the completion of step 3806, the expandable tubular member 3802a includes a microstructure that includes bainite, pearlite, and new ferrite. In an exemplary experimental embodiment, following the completion of step 3806, the expandable tubular member 3802a has a yield strength of 60 ksi, and a tensile strength of 97 ksi.

[00357] In an exemplary embodiment, the expandable tubular member 3802a is then radially expanded and plastically deformed using one or more of the methods and apparatus described above. In an exemplary embodiment, following the radial expansion and plastic deformation of the expandable tubular member 3802a, the yield strength of the expandable tubular member is about 97 ksi.

[00358] Referring now to Fig. 39, a method for manufacturing an expandable tubular member 3900 is illustrated. The method 3900 begins at step 3902 with providing a tubular member. In an exemplary embodiment, the tubular member may be any conventional tubular member or any conventional connection for expandable tubular members. At step 3904, the tubular member is given a heat treatment using methods known in the art. At step 3906, the tubular member is then quenched and, in step 3908, the tubular member is cold worked. In an exemplary embodiment, the tubular member is an X-52-1 pipe, with a chemical composition, by weight percentage, of 0.08%C, 0.82% Mn, 0.006% P, 0.003% S, 0.30% Si, 0.16% Cu, 0.05% Ni, 0.05% Cr, 0.06% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti, and is quenched in water at approximately 705 °C, resulting in a tensile strength of 94 ksi and a yield strength of 56 ksi. In an exemplary embodiment, the tubular member is a JFE-A-1 pipe, with a chemical composition, by weight percentage, of 0.065% C, 1.44% MN, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.04% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti, and is quenched in water at approximately 790 °C, resulting in a tensile strength of 94 ksi and a yield strength of 59 ksi. In an exemplary embodiment, the tubular member is a JFE-B-1 pipe, with a chemical composition, by weight percentage, of 0.18%C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.03% V, 0.03% Mo, 0.01%

Nb, and 0.01% Ti, and is quenched in water at approximately 735 °C, resulting in a tensile strength of 94 ksi and a yield strength of 56 ksi. In an exemplary embodiment, the tubular member is an X-52-2 pipe, with a chemical composition, by weight percentage, of 0.08%C, 0.82% Mn, 0.006% P, 0.003% S, 0.30% Si, 0.16% Cu, 0.05% Ni, 0.05% Cr, 0.06% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti, and is quenched in oil at approximately 775 °C, resulting in a tensile strength of 84 ksi and a yield strength of 49 ksi. In an exemplary embodiment, the tubular member is a JFE-A-2 pipe, with a chemical composition, by weight percentage, of 0.065% C, 1.44% MN, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.04% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti, and is quenched in oil at approximately 820 °C, resulting in a tensile strength of 92 ksi and a yield strength of 61 ksi. In an exemplary embodiment, the tubular member is a JFE-B-2 pipe, with a chemical composition, by weight percentage, of 0.18%C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.03% V, 0.03% Mo, 0.01% Nb, and 0.01% Ti, and is quenched in oil at approximately 750 °C, resulting in a tensile strength of 109 ksi and a yield strength of 58 ksi. In an exemplary embodiment, an expandable tubular member processed by the method 3900 may, upon radial expansion, achieve an increased yield strength.

[00359] Referring now to Fig. 40, a method for expanding an expandable tubular member is illustrated. The method 4000 begins at step 4002 where a tubular member is provided. In an exemplary embodiment, the tubular member provided is manufactured by the method 3900 of Fig. 39. At step 4004, the tubular member is lubricated, and in step 4006, the tubular member is expanded. In an exemplary embodiment, the lubricant is a EGT MS-9075, commercially available from Brighton Inc., which results in a coefficient of friction of 0.125 and a required expansion force of approximately 146000 lbs. In an exemplary embodiment, the lubricant is a EGT MS-9075, commercially available from Brighton Inc., which results in a coefficient of friction of 0.075 and a required expansion force of approximately 143000 lbs. In an exemplary embodiment, the lubricant is a Brighton lubricant, commercially available from Brighton Inc., with grease which results in a coefficient of friction of 0.02 and a required expansion force of approximately 150000 lbs. In an exemplary embodiment, the lubricant is EGT MS-9075 lubricant, commercially available from Brighton Inc., used on a 55 ksi steel which results in a coefficient of friction of 0.02 and a required expansion force of approximately 126000 lbs. In an exemplary embodiment, the lubricant is EGT MS-9075 lubricant, commercially available from Brighton Inc., used on a steel pipe with a 55 ksi yield strength before pipe expansion and a 100 ksi yield strength after expansion which results in a coefficient of friction of 0.02 and a required expansion force of approximately 127000 lbs. In an exemplary embodiment, the lubrication of the tubular member decreases the force needed to expand the tubular member, allowing a thicker pipe to be used for the same expansion force, resulting in a higher collapse strength.

[00360] Referring now to Fig. 41, a method 4100 for formability evaluation for a material suitable for expandable tubular members is illustrated including a plurality of parameters. A stress-strain properties parameter 4102 is used to determine the optimum combination of the strength and elongation for the material. A Charpy V-notch impact value parameter 4104 is used to predict the likelihood of brittle fracture for the material. A stress rupture parameter 4106 is used and may include a burst and collapse value which should be optimized considering higher strength against decreased ductility with increased susceptibility to environmental cracking. A strain-hardening exponent parameter 4108 is used to find higher values such that the material should not fail during radial expansion. A plastic strain ratio 4110 is determined by comparing the strains in the width and thickness direction and used to find ratios 4110 greater than 1 indicating materials which are good for manufacturing an expandable tubular member such as, for example, through the method 4000 illustrated in Fig. 40.

[00361] In an exemplary experimental embodiment, as illustrated in Fig. 42, an expandable tubular member 4200 may be provided using, for example, the method 3900 illustrated in Fig. 39, with a minimum flare expansion of 45%, a tensile strength of 60-120 ksi, a yield strength of 40-100 ksi, a yield strength to tensile strength ratio of 50-85%, an minimum elongation change due to radial expansion of 35%, a minimum width reduction due to radial expansion of 40%, a minimum thickness reduction due to radial expansion of 30%, and a minimum anisotropy of 1.5. In an exemplary embodiment, the absorbed energy of the expandable tubular member 4200 at negative 4 degrees Fahrenheit is 80 ft-lb in a longitudinal direction, 60 ft-lb in a transverse direction, and 60 ft-lb in a transverse weld area.

[00362] In an exemplary experimental embodiment, as illustrated in Fig. 43, a method 4300 is provided for transforming the yield strength of an expandable tubular member. In an exemplary embodiment, the expandable tubular member includes a dual-phase steel composition including, by weight percentage, 0.12% C, 0.4% Si, 1.5% Mn, and 0.02% Nb. The manufactured tubular member 4302 includes a yield strength of approximately 50 ksi. After cold rolling at 4304, the yield strength of the expandable tubular member 4300 increases to approximately 120 ksi. The expandable tubular member 4300 is then annealed at 4306, reducing its yield strength to approximately 35 ksi. The expandable tubular member 4300 may then be radially expanded at 4308, increasing the yield strength to approximately 90 ksi. Baking at 4310 will further increase the yield strength of the expandable tubular member 4300 to approximately 100 ksi.

[00363] In an exemplary experimental embodiment, as illustrated in Fig. 44, an expandable tubular member 4400 may be provided using, for example, the method 3900 illustrated in Fig. 39, with a minimum flare expansion of 45%, a tensile strength of 60-100 ksi, a yield strength of 60-90 ksi, a maximum yield strength to tensile strength ratio of 85%,

an minimum elongation change due to radial expansion of 22%, a minimum width reduction due to radial expansion of 30%, a minimum thickness reduction due to radial expansion of 35%, and a minimum anisotropy of 0.5. In an exemplary embodiment, the absorbed energy of the expandable tubular member 4200 at negative 4 degrees Fahrenheit is 80 ft-lb in a longitudinal direction, 60 ft-lb in a transverse direction, and 60 ft-lb in a transverse weld area.

[00364] In an exemplary experimental embodiment, as illustrated in Fig. 45, an expandable tubular member 4500 may be provided using, for example, the method 3900 illustrated in Fig. 39, with a minimum flare expansion of 75%, a tensile strength of 60-120 ksi, a yield strength of 40-100 ksi, a yield strength to tensile strength ratio of 50-85%, an minimum elongation change due to radial expansion of 35%, a minimum width reduction due to radial expansion of 40%, a minimum thickness reduction due to radial expansion of 30%, and a minimum anisotropy of 1.5. In an exemplary embodiment, the absorbed energy of the expandable tubular member 4200 at negative 4 degrees Fahrenheit is 80 ft-lb in a longitudinal direction, 60 ft-lb in a transverse direction, and 60 ft-lb in a transverse weld area.

[00365] In an exemplary experimental embodiment, as illustrated in Fig. 46, a method 4600 is provided for transforming the yield strength of an expandable tubular member 4602. The expandable tubular member 4602 includes a yield strength of approximately 70 ksi. The expandable tubular member 4602 may then be annealed at 4604, reducing its yield strength to approximately 30 ksi. The expandable tubular member 4602 may then be expanded at 4606, increasing the yield strength to approximately 90 ksi. Baking at 4608 may further increase the yield strength of the expandable tubular member 4602 to approximately 100 ksi. In an exemplary embodiment, the cold rolling in step 4304 may be omitted.

[00366] In an exemplary experimental embodiment, as illustrated in Fig. 47, an expandable tubular member 4700 may be provided using, for example, the method 3900 illustrated in Fig. 39, including a yield strength of approximately 77 ksi, a tensile strength of approximately 83 ksi, and an elongation change due to radial expansion of 32%. In several exemplary embodiments, the tubular member 4700 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1 or JFE-B-2 tubulars described above.

[00367] In an exemplary embodiment, as illustrated in Fig. 48, an expansion device 4800 includes a textured external surface 4802 having a self lubricating hard coating 4804 applied onto the external surface. A self lubricating soft coating/film grease and lubricated mud 4806 may also be applied onto the external surface 4802, alone, or in combination with the lubricating hard coating 4804. In an exemplary embodiment, the application of the lubricant coatings 4804 and 4806 result in a friction coefficient of not more than 0.05, and the lubricant coating 4806 may withstand abrasive and corrosive environment, while the lubricant 4804 may withstand multiple expansions and abrasive and corrosive environments.

[00368] In an exemplary experimental embodiment, as illustrated in Fig. 49, a force of approximately 140000 lbs was required to radially expand an expandable tubular member 4902 with a coefficient of friction greater than about 0.100 during the radial expansion process. In another exemplary experimental embodiment, a force of approximately 118000 lbs was require to radially expand an expandable tubular member 4904 with a coefficient of friction between about 0.05 and 0.075 during the radial expansion process. In several exemplary embodiments, the tubular members 4902 and 4904 may be one or more of X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1 or JFE-B-2 tubulars described above.

[00369] In an exemplary embodiment, as illustrated in Fig. 50a and 50b, an expandable tubular member 5000 may be provided using, for example, the method 3900 illustrated in Fig. 39, which includes a yield strength in the range of 40 ksi to 80 ksi, a maximum yield to tensile ratio of less than 0.5, an elongation 5006 of greater than 30%, a minimum width reduction due to radial expansion of greater than 45%, a minimum wall thickness reduction due to radial expansion of greater than 30%, and a minimum anisotropy of greater than 1.5. In several exemplary embodiments, the tubular member 5000 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1 or JFE-B-2 tubulars described above.

[00370] In an exemplary experimental embodiment, as illustrated in Fig. 51, radial expansion of an expandable tubular member 5100 required a load of approximately 150000 lbs. In an exemplary experimental embodiment, radial expansion of an expandable tubular member 5102 including EGT MS-9075 lubricant coating, commercially available from Brighton Inc., required a load of approximately 125000 lbs. In an exemplary experimental embodiment, radial expansion of an expandable tubular member 5104 including EGT MS-9075 lubricant coating, commercially available from Brighton Inc., and a grease lubricant coating required a load of approximately 95000 lbs. In an exemplary embodiment, radial expansion of an expandable tubular member 5106 including EGT MS-9075 lubricant coating, commercially available from Brighton Inc., and a grease lubricant coating required a load of approximately 80000 lbs. In an exemplary embodiment, the expandable tubular members 5102, 5104, and 5106 may be expanded using the method 4000 illustrated in Fig. 40. In several exemplary embodiments, the tubular members, 5102, 5104, and/or 5106, may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1 or JFE-B-2 tubulars described above.

[00371] In an exemplary experimental embodiment, as illustrated in Fig. 52, an expandable tubular member 5200 including a Brighton BSFL lubricant coating, commercially available from Brighton Inc., resulted in a friction coefficient of 0.125, a required radial expansion force of approximately 146000 lbs, a wall thickness of 0.305, a diameter to thickness ratio of 24.8, and a collapse strength of approximately 2400 ksi. In an exemplary

experimental embodiment, an expandable tubular member 5202 including EGT MS-9075 lubricant coating, commercially available from Brighton Inc., resulted in a friction coefficient of 0.075, a required expansion force of approximately 143000 lbs, a wall thickness of 0.350, a diameter to thickness ratio of 21.6, and a collapse strength of approximately 3250 ksi. In an exemplary experimental embodiment, an expandable tubular member 5204 including EGT MS-9075 lubricant coating, commercially available from Brighton Inc., and grease lubricant coating resulted in a friction coefficient of 0.02, a required expansion force of approximately 150000 lbs, a wall thickness of 0.450, a diameter to thickness ratio of 16.8, and a collapse strength of approximately 5800 ksi. In an exemplary experimental embodiment, an expandable tubular member 5206 including a 55 ksi steel and EGT MS-9075 lubricant coating, commercially available from Brighton Inc., and grease lubricant coating resulted in a friction coefficient of 0.02, a required expansion force of approximately 126000 lbs, a wall thickness of 0.500, a diameter to thickness ratio of 15.1, and a collapse strength of approximately 5350 ksi. In an exemplary experimental embodiment, an expandable tubular member 5208 including EGT MS-9075 lubricant coating, commercially available from Brighton Inc., resulted in a friction coefficient of 0.02, a required expansion force of approximately 127000 lbs, a wall thickness of 0.500, a diameter to thickness ratio of 15.1, and a collapse strength of approximately 8400 ksi. In an exemplary embodiment, the expandable tubular members 5200, 5202, 5204, 5206, and 5208 may be radially expanded using the method 4000, illustrated in Fig. 40. In several exemplary embodiments, the tubular members, 5200, 5202, 5204, 5206, and/or 5208, may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1 or JFE-B-2 tubulars described above.

[00372] In an exemplary experimental embodiment, as illustrated in Fig. 53, an expandable tubular member 5300 included a composition, by weight percentage, of 0.065% C, 1.44% MN, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.04% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti. In an exemplary experimental embodiment, an expandable tubular member 5302 included a composition, by weight percentage, of 0.18%C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.03% V, 0.03% Mo, 0.01% Nb, and 0.01% Ti. In an exemplary experimental embodiment, an expandable tubular member 5304 included a composition, by weight percentage, of 0.08%C, 0.82% Mn, 0.006% P, 0.003% S, 0.30% Si, 0.16% Cu, 0.05% Ni, 0.05% Cr, 0.06% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti. In an exemplary experimental embodiment, an expandable tubular member 5306 included a composition, by weight percentage, of 0.03%C, 1.48% Mn, 0.014% P, 0.002% S, 0.16% Si, 0.02% Cu, 0.01% Ni, 0.02% Cr, 0.06% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti.

[00373] In an exemplary experiment embodiment, as illustrated in Fig. 54, an expandable tubular member 5400 produced using, for example, the method 3900 illustrated

in Fig. 39, included, after a radial expansion of 16%, a yield strength 5402 change due to expansion of approximately 22%, a yield ratio 5404 change due to radial expansion of approximately 24%, an elongation percentage 5406 change due to radial expansion of approximately 18%, a width reduction percentage 5408 change due to radial expansion of approximately 8%, a wall thickness reduction percentage 5410 change due to radial expansion of approximately 15%, and a anisotropy percentage 5412 change due to radial expansion of approximately 4%. In several exemplary embodiments, the tubular member 5400 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00374] In an exemplary experiment embodiment, as illustrated in Fig. 55, an expandable tubular member 5500 produced using, for example, the method 3900 illustrated in Fig. 39, included, after a radial expansion of 15.6%, a yield strength 5502 change due to radial expansion of approximately 70%, a yield ratio 5504 change due to radial expansion of approximately 25%, an elongation percentage 5506 change due to radial expansion of approximately 67%, a width reduction percentage 5508 change due to radial expansion of approximately 28%, a wall thickness reduction percentage 5510 change due to radial expansion of approximately 7%, and a anisotropy percentage 5512 change due to radial expansion of approximately 75%. In several exemplary embodiments, the tubular member 5500 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00375] In an exemplary experiment embodiment, as illustrated in Fig. 56, an expandable tubular member 5600 produced using, for example, the method 3900 illustrated in Fig. 39, included, after a radial expansion of 24%, a yield strength 5602 change due to radial expansion of approximately 10%, a yield ratio 5604 change due to radial expansion of approximately 3%, an elongation percentage 5606 change due to radial expansion of approximately 30%, a width reduction percentage 5608 change due to radial expansion of approximately 13%, a wall thickness reduction percentage 5610 change due to radial expansion of approximately 2%, and a anisotropy percentage 5612 change due to radial expansion of approximately 17%. In several exemplary embodiments, the tubular member 5600 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00376] In an exemplary experiment embodiment, as illustrated in Fig. 57, an expandable tubular member 5700 produced using, for example, the method 3900 illustrated in Fig. 39, included, after a radial expansion of 24%, a yield strength 5702 change due to radial expansion of approximately 46%, a yield ratio 5704 change due to radial expansion of approximately 20%, an elongation percentage 5706 change due to radial expansion of approximately 91%, a width reduction percentage 5708 change due to radial expansion of

approximately 15%, a wall thickness reduction percentage 5710 change due to radial expansion of approximately 2%, and a anisotropy percentage 5712 change due to radial expansion of approximately 18%. In several exemplary embodiments, the tubular member 5700 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00377] In an exemplary experiment embodiment, as illustrated in Fig. 58, an expandable tubular member 5800 produced using, for example, the method 3900 illustrated in Fig. 39, included, after a radial expansion of 16%, a yield strength 5802 change due to radial expansion of approximately 38%, a yield ratio 5804 change due to radial expansion of approximately 20%, an elongation percentage 5806 change due to radial expansion of approximately 11%, a width reduction percentage 5808 change due to radial expansion of approximately 9%, a wall thickness reduction percentage 5810 change due to radial expansion of approximately 4%, and a anisotropy percentage 5812 change due to radial expansion of approximately 4%. In several exemplary embodiments, the tubular member 5800 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00378] In an exemplary experiment embodiment, as illustrated in Fig. 59, an expandable tubular member 5900 produced using, for example, the method 3900 illustrated in Fig. 39, included, after a radial expansion of 24%, a yield strength 5902 change due to radial expansion of approximately 31%, a yield ratio 5904 change due to radial expansion of approximately 14%, an elongation percentage 5906 change due to radial expansion of approximately 48%, a width reduction percentage 5908 change due to radial expansion of approximately 13%, a wall thickness reduction percentage 5910 change due to radial expansion of approximately 2%, and a anisotropy percentage 5912 change due to radial expansion of approximately 12%. In several exemplary embodiments, the tubular member 5900 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00379] In an exemplary experiment embodiment, as illustrated in Fig. 60, an expandable tubular member 6000 produced using, for example, the method 3900 illustrated in Fig. 39, included, after a radial expansion of 24%, a yield strength 6002 change due to radial expansion of approximately 38%, a yield ratio 6004 change due to radial expansion of approximately 21%, an elongation percentage 6006 change due to radial expansion of approximately 55%, a width reduction percentage 6008 change due to radial expansion of approximately 16%, a wall thickness reduction percentage 6010 change due to radial expansion of approximately 9%, and a anisotropy percentage 6012 change due to radial expansion of approximately 13%. In several exemplary embodiments, the tubular member

6000 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00380] In an exemplary experiment embodiment, as illustrated in Fig. 61, an expandable tubular member 6100 produced using, for example, the method 3900 illustrated in Fig. 39, included, after a radial expansion of 16%, a yield strength 6102 change due to radial expansion of approximately 33%, a yield ratio 6104 change due to radial expansion of approximately 26%, an elongation percentage 6106 change due to radial expansion of approximately 30%, a width reduction percentage 6108 change due to radial expansion of approximately 15%, a wall thickness reduction percentage 6110 change due to radial expansion of approximately 9%, and a anisotropy percentage 6112 change due to radial expansion of approximately 10%. In several exemplary embodiments, the tubular member 6100 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00381] In an exemplary experiment embodiment, as illustrated in Fig. 62, an expandable tubular member 6200 produced using, for example, the method 3900 illustrated in Fig. 39, included, after a radial expansion of 24%, a yield strength 6202 change due to radial expansion of approximately 41%, a yield ratio 6204 change due to radial expansion of approximately 27%, an elongation percentage 6206 change due to radial expansion of approximately 40%, a width reduction percentage 6208 change due to radial expansion of approximately 21%, a wall thickness reduction percentage 6210 change due to radial expansion of approximately 16%, and a anisotropy percentage 6212 change due to radial expansion of approximately 5%. In several exemplary embodiments, the tubular member 6200 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00382] In an exemplary experimental embodiment, as illustrated in Fig. 63, an expandable tubular member 6300 produced using, for example, the method 3900 illustrated in Fig. 39, included a yield strength 6302 of approximately 68 ksi before radial expansion, a yield strength 6304 of approximately 80 ksi after 16% radial expansion, and a yield strength 6306 of approximately 82 ksi after 24% radial expansion. In several exemplary embodiments, the tubular member 6300 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00383] In an exemplary experimental embodiment, as illustrated in Fig. 64, an expandable tubular member 6400 produced using, for example, the method 3900 illustrated in Fig. 39, included a yield strength 6402 of approximately 69 ksi before radial expansion, a yield strength 6404 of approximately 83 ksi after 16% radial expansion, and a yield strength 6406 of approximately 88 ksi after 24% radial expansion. In several exemplary embodiments, the tubular member 6400 may be one or more of the X X-52-1, X-52-2, JFE-

A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00384] In an exemplary experimental embodiment, as illustrated in Fig. 65, an expandable tubular member 6500 produced using, for example, the method 3900 illustrated in Fig. 39, included a yield strength 6502 of approximately 80 ksi before radial expansion, a yield strength 6504 of approximately 90 ksi after 16% radial expansion, and a yield strength 6506 of approximately 92 ksi after 24% radial expansion. In several exemplary embodiments, the tubular member 6500 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00385] In an exemplary experimental embodiment, as illustrated in Fig. 66, an expandable tubular member 6600 produced using, for example, the method 3900 illustrated in Fig. 39, included a yield strength 6602 of approximately 108 ksi before radial expansion, a yield strength 6604 of approximately 120 ksi after 15.2% radial expansion, and a yield strength 6606 of approximately 121 ksi after 25.2% radial expansion. In several exemplary embodiments, the tubular member 6600 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00386] In an exemplary experimental embodiment, as illustrated in Fig. 67, an expandable tubular member 6700 produced using, for example, the method 3900 illustrated in Fig. 39, included a yield strength 6702 of approximately 100 ksi before radial expansion and a yield strength 6704 of approximately 127 ksi after 31.3% radial expansion. In several exemplary embodiments, the tubular member 6700 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00387] In an exemplary experimental embodiment, as illustrated in Fig. 68a and 68b, an expandable tubular member 6800 produced using, for example, the method 3900 illustrated in Fig. 39, included a yield strength 6802 of approximately 118 ksi before radial expansion and a yield strength 6804 of approximately 140 ksi after 15.6% radial expansion. In an exemplary experimental embodiment, an expandable tubular member 6806 is produced using, for example, the method 3900 illustrated in Fig. 39, that includes a yield strength of approximately 51 ksi, a yield strength to tensile strength ratio of approximately 0.44, a longitudinal elongation change due to radial expansion of approximately 12%, a width reduction due to radial expansion of approximately 18%, a wall thickness reduction due to radial expansion of approximately 15%, and an anisotropy of approximately 1.24. In several exemplary embodiments, the tubular members, 6800 and 6806, may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00388] In an exemplary experimental embodiment, as illustrated in Fig. 69, an expandable tubular member 6900 begins with a tensile strength 6902 of approximately 85 ksi and a yield strength 6904 of approximately 55 ksi. After quenching in water at approximately 775 °C, the expandable tubular member 6900 includes a tensile strength 6908 of 94 ksi and a yield strength 6910 of 56 ksi. In an exemplary embodiment, the expandable tubular member 6900 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular member 6900 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00389] In an exemplary experimental embodiment, as illustrated in Fig. 70, an expandable tubular member 7000 begins with a tensile strength 7002 of approximately 69 ksi and a yield strength 7004 of approximately 45 ksi. After quenching in water at approximately 790 °C, the expandable tubular member 7000 includes a tensile strength 7008 of 94 ksi and a yield strength 7010 of 59 ksi. In an exemplary embodiment, the expandable tubular member 7000 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular member 7000 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00390] In an exemplary experimental embodiment, as illustrated in Fig. 71, an expandable tubular member 7100 begins with a tensile strength 7102 of approximately 80 ksi and a yield strength 7104 of approximately 59 ksi. After quenching in water at approximately 735 °C, the expandable tubular member 7100 includes a tensile strength 7108 of 94 ksi and a yield strength 7110 of 59 ksi. In an exemplary embodiment, the expandable tubular member 7100 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular member 7100 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00391] In an exemplary experimental embodiment, as illustrated in Fig. 72, an expandable tubular member 7200 begins with a tensile strength 7202 of approximately 75 ksi and a yield strength 7204 of approximately 55 ksi. After quenching in oil at approximately 775 °C, the expandable tubular member 7200 includes a tensile strength 7208 of 84 ksi and a yield strength 7210 of 49 ksi. In an exemplary embodiment, the expandable tubular member 7200 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular member 7200 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00392] In an exemplary experimental embodiment, as illustrated in Fig. 73, an expandable tubular member 7300 begins with a tensile strength 7302 of approximately 69 ksi and a yield strength 7304 of approximately 45 ksi. After quenching in oil at approximately 820 °C, the expandable tubular member 7300 includes a tensile strength 7308 of 92 ksi and a yield strength 7310 of 61 ksi. In an exemplary embodiment, the expandable tubular member 7300 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular member 7300 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00393] In an exemplary experimental embodiment, as illustrated in Fig. 74, an expandable tubular member 7400 begins with a tensile strength 7402 of approximately 80 ksi and a yield strength 7404 of approximately 60 ksi. After quenching in oil at approximately 750 °C, the expandable tubular member 7400 includes a tensile strength 7408 of 109 ksi and a yield strength 7410 of 58 ksi. In an exemplary embodiment, the expandable tubular member 7400 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular member 7400 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00394] In an exemplary experimental embodiment, as illustrated in Fig. 75, expandable tubular members, 7500, 7502 and 7504, are produced by quenching and tempering. Expandable tubular member 7500 includes a yield strength 7506 of approximately 80, a yield strength to tensile strength ratio 7508 of approximately 0.86, an elongation change due to radial expansion 7510 of approximately 14.8%, a width reduction due to radial expansion 7512 of approximately 38%, a wall thickness reduction due to radial expansion 7514 of approximately 43%, and an anisotropy 7516 of approximately 0.87. Expandable tubular member 7502 includes a yield strength 7506 of approximately 81, a yield strength to tensile strength ratio 7508 of approximately 0.83, an elongation change due to radial expansion 7510 of approximately 14.9%, a width reduction 7512 of approximately 38%, a wall thickness reduction due to radial expansion 7514 of approximately 43.3%, and an anisotropy 7516 of approximately 0.83. Expandable tubular member 7504 includes a yield strength 7506 of approximately 79, a yield strength to tensile strength ratio 7508 of approximately 0.82, an elongation change due to radial expansion 7510 of approximately 15.9%, a width reduction due to radial expansion 7512 of approximately 44%, a wall thickness reduction due to radial expansion 7514 of approximately 43.3%, and an anisotropy 7516 of approximately 1.03. In an exemplary embodiment, the expandable tubular member 7500 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular members, 7500, 7502, and/or 7504, may be one or

more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00395] In an exemplary experimental embodiment, as illustrated in Fig. 76, expandable tubular members, 7600 and 7602, are produced by quenching and tempering. Expandable tubular member 7600 includes a yield strength 7504 of approximately 80 ksi, a yield strength to tensile strength ratio 7506 of approximately 0.86, an elongation change due to radial expansion 7508 of approximately 14.8%, a width reduction due to radial expansion 7510 of approximately 38%, a wall thickness reduction due to radial expansion 7512 of approximately 43%, and an anisotropy 7514 of approximately 0.87. Expandable tubular member 7502 includes a yield strength 7504 of approximately 80 ksi, a yield strength to tensile strength ratio 7506 of approximately 0.83, an elongation change due to radial expansion 7508 of approximately 15.3%, a width reduction due to radial expansion 7510 of approximately 40.4%, a wall thickness reduction due to radial expansion 7512 of approximately 43.3%, and an anisotropy 7514 of approximately 0.92. In an exemplary embodiment, the expandable tubular member 7600 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular members, 7600 and 7602, may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00396] In an exemplary experimental embodiment, as illustrated in Figs. 77a and 77b, an expandable tubular member 7700 may be produced, for example, using the method 4000 of Fig. 40, including an elongation change due to radial expansion of 21%, a width reduction due to radial expansion of 35%, a wall thickness reduction due to radial expansion of 38%, and an anisotropy of 0.89. Expandable tubular member 7700 includes a stress-strain curve 7702 including a tensile strength of approximately 100 ksi. In an exemplary embodiment, the expandable tubular member 7700 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular member 7700 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00397] In an exemplary experimental embodiment, as illustrated in Figs. 78a and 78b, an expandable tubular member 7800 was produced by quenching and tempering that included a yield strength of approximately 85 ksi, a yield strength to tensile strength ratio of approximately 0.85, a longitudinal elongation change due to radial expansion of approximately 21%, a width reduction due to radial expansion of approximately 39%, a wall thickness reduction due to radial expansion of 43%, and an anisotropy of 0.88. Expandable tubular member 7800 includes a stress-strain curve 7802 including a tensile strength of approximately 100 ksi. In an exemplary embodiment, the expandable tubular member 7800 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several

exemplary embodiments, the tubular member 7800 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00398] In an exemplary experimental embodiment, as illustrated in Figs. 79a and 79b, an expandable tubular member 7900 was produced by quenching and tempering that included a yield strength of approximately 89 ksi, a yield strength to tensile strength ratio of approximately 0.86, a longitudinal elongation change due to radial expansion of approximately 22%, a width reduction due to radial expansion of approximately 39%, a wall thickness reduction due to radial expansion of 41%, and an anisotropy of 0.93. Expandable tubular member 7900 includes a stress-strain curve 7902 including a tensile strength of approximately 100 ksi. In an exemplary embodiment, the expandable tubular member 7900 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular member 7900 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00399] In an exemplary experimental embodiment, as illustrated in Figs. 80a and 80b, an expandable tubular member 8000 was produced by quenching and tempering that included a yield strength of approximately 84 ksi, a yield strength to tensile strength ratio of approximately 0.84, a longitudinal elongation change due to radial expansion of approximately 21%, a width reduction due to radial expansion of approximately 40%, a wall thickness reduction due to radial expansion of 42%, and an anisotropy of 0.94. Expandable tubular member 8002 includes a stress-strain curve 7902 including a tensile strength of approximately 108 ksi. In an exemplary embodiment, the expandable tubular member 8000 may be produced using, for example, the method 3900 illustrated in Fig. 39. In several exemplary embodiments, the tubular member 8000 may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00400] In an exemplary experimental embodiment, as illustrated in Fig. 81, an expandable tubular member 8100 may be produced, for example, using the method 3900 of Fig. 39, including a yield strength of approximately 80 ksi, a yield strength to tensile strength ratio of approximately 0.72, an elongation change due to radial expansion of approximately 35%, a width reduction due to radial expansion of approximately 35%, a wall thickness reduction due to radial expansion of approximately 33%, and an anisotropy of approximately 0.92. In an exemplary embodiment, expandable tubular member 8100 is produced by hot stretching, reducing at 1950 °C, and rotary straightening. An expandable tubular member 8102 was produced that included a yield strength of approximately 90 ksi, a yield strength to tensile strength ratio of approximately 0.88, an elongation change due to radial expansion of

approximately 25%, a width reduction due to radial expansion of approximately 22%, a wall thickness reduction due to radial expansion of approximately 20%, and an anisotropy of approximately 1.1. In an exemplary embodiment, expandable tubular member 8102 is produced by normalizing at 1850 °C, cold drawing, annealing at 1050 °C, and rotary straightening. An expandable tubular member 8104 was produced that included a yield strength of approximately 88 ksi, a yield strength to tensile strength ratio of approximately 0.87, an elongation change due to radial expansion of approximately 16%, a width reduction due to radial expansion of approximately 24%, a wall thickness reduction due to radial expansion of approximately 30%, and an anisotropy of approximately 0.76. In an exemplary embodiment, expandable tubular member 8104 is produced by hot stretching, reducing at 1950 °C, cold drawing, annealing, and rotary straightening. An expandable tubular member 8106 was produced that included a yield strength of approximately 48 ksi, a yield strength to tensile strength ratio of approximately 0.73, an elongation change due to radial expansion of approximately 38%, a width reduction due to radial expansion of approximately 43%, a wall thickness reduction due to radial expansion of approximately 49%, and an anisotropy of approximately 0.83. In an exemplary embodiment, expandable tubular member 8106 is produced by hot stretching, reducing at 1850 °C, and rotary straightening. An expandable tubular member 8108 was produced that included a yield strength of approximately 46 ksi, a yield strength to tensile strength ratio of approximately 0.69, an elongation change due to radial expansion of approximately 40%, a width reduction due to radial expansion of approximately 50%, a wall thickness reduction due to radial expansion of approximately 53%, and an anisotropy of approximately 0.93. In an exemplary embodiment, expandable tubular member 8108 is produced by hot reducing at 1850 °C, cold sizing, and rotary straightening. An expandable tubular member 8110 was produced that included a yield strength of approximately 53 ksi, a yield strength to tensile strength ratio of approximately 0.85, an elongation change due to radial expansion of approximately 49%, a width reduction due to radial expansion of approximately 49%, a wall thickness reduction due to radial expansion of approximately 2046 and an anisotropy of approximately 1.1. In an exemplary embodiment, expandable tubular member 8110 is produced by hot stretching, reducing at 1850 °C, and rotary straightening. In several exemplary embodiments, the tubular members, 8100, 8102, 8104, 8106, 8108, and 8110, may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00401] In an exemplary embodiment, as illustrated in Fig. 82, an expandable tubular member 8200 may be produced, for example, using the method 3900 of Fig. 39, including a 42% flare expansion, absorbed energy in the longitudinal direction of 125 ft-lbs, absorbed energy in the transverse direction of 59 ft-lbs, and absorbed energy in the weld of 176 ft-lbs.

An expandable tubular member 8202 was produced that included a 52% flare expansion, absorbed energy in the longitudinal direction of 145 ft-lbs, absorbed energy in the transverse direction of 59 ft-lbs, and absorbed energy in the weld of 174 ft-lbs. In several exemplary embodiments, the tubular members, 8200 and 8202, may be one or more of the X-52-1, X-52-2, JFE-A-1, JFE-A-2, JFE-B-1, JFE-B-2, 5302, 5304, 5306 or 5308 tubular members described above.

[00402] In several exemplary embodiments, the teachings of the present disclosure are combined with one or more of the teachings disclosed in FR 2 841 626, filed on 6/28/2002, and published on 1/2/2004, the disclosure of which is incorporated herein by reference.

[00403] A method of forming a tubular liner within a preexisting structure has been described that includes positioning a tubular assembly within the preexisting structure; and radially expanding and plastically deforming the tubular assembly within the preexisting structure, wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a larger inside diameter after the radial expansion and plastic deformation than other portions of the tubular assembly. In an exemplary embodiment, the method further includes positioning another tubular assembly within the preexisting structure in overlapping relation to the tubular assembly; and radially expanding and plastically deforming the other tubular assembly within the preexisting structure, wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the other tubular assembly has a lower yield point than another portion of the other tubular assembly. In an exemplary embodiment, the inside diameter of the radially expanded and plastically deformed other portion of the tubular assembly is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly includes an end portion of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly includes a plurality of predetermined portions of the tubular assembly. In

an exemplary embodiment, the predetermined portion of the tubular assembly includes a plurality of spaced apart predetermined portions of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly includes an end portion of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly includes a plurality of other portions of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly includes a plurality of spaced apart other portions of the tubular assembly. In an exemplary embodiment, the tubular assembly includes a plurality of tubular members coupled to one another by corresponding tubular couplings. In an exemplary embodiment, the tubular couplings include the predetermined portions of the tubular assembly; and wherein the tubular members comprise the other portion of the tubular assembly. In an exemplary embodiment, one or more of the tubular couplings include the predetermined portions of the tubular assembly. In an exemplary embodiment, one or more of the tubular members include the predetermined portions of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly defines one or more openings. In an exemplary embodiment, one or more of the openings include slots. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1. In an exemplary embodiment, the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1; and the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the predetermined portion of the tubular assembly is a first steel alloy including: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.48. In an exemplary embodiment, the predetermined portion of the tubular assembly includes a second steel alloy including: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial

expansion and plastic deformation; and the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.04. In an exemplary embodiment, the predetermined portion of the tubular assembly includes a third steel alloy including: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.92. In an exemplary embodiment, the predetermined portion of the tubular assembly includes a fourth steel alloy including: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.34. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.48. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.04. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.92. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to

the radial expansion and plastic deformation, is at least about 1.34. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is greater than 0.12. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the tubular assembly is greater than the expandability coefficient of the other portion of the tubular assembly. In an exemplary embodiment, the tubular assembly includes a wellbore casing, a pipeline, or a structural support. In an exemplary embodiment, the carbon content of the predetermined portion of the tubular assembly is less than or equal to 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.21. In an exemplary embodiment, the carbon content of the predetermined portion of the tubular assembly is greater than 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.36. In an exemplary embodiment, a yield point of an inner tubular portion of at least a portion of the tubular assembly is less than a yield point of an outer tubular portion of the portion of the tubular assembly. In an exemplary embodiment, yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the outer tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the outer tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body. In an

exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body. In an exemplary embodiment, the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body. In an exemplary embodiment, prior to the radial expansion and plastic deformation, at least a portion of the tubular assembly comprises a microstructure comprising a hard phase structure and a soft phase structure. In an exemplary embodiment, prior to the radial expansion and plastic deformation, at least a portion of the tubular assembly comprises a microstructure comprising a transitional phase structure. In an exemplary embodiment, the hard phase structure comprises martensite. In an exemplary embodiment, the soft phase structure comprises ferrite. In an exemplary embodiment, the transitional phase structure comprises retained austentite. In an exemplary embodiment, the hard phase structure comprises martensite; wherein the soft phase structure comprises ferrite; and wherein the transitional phase structure comprises retained austentite. In an exemplary embodiment, the portion of the tubular assembly comprising a microstructure comprising a hard phase structure and a soft phase structure comprises, by weight percentage, about 0.1% C, about 1.2% Mn, and about 0.3% Si.

[00404] An expandable tubular member has been described that includes a steel alloy including: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr. In an exemplary embodiment, a yield point of the tubular member is at most about 46.9 ksi prior to a radial expansion and plastic deformation; and a yield point of the tubular member is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the tubular member after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the tubular member prior to the radial expansion and plastic deformation. In an exemplary

embodiment, the anisotropy of the tubular member, prior to a radial expansion and plastic deformation, is about 1.48. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00405] An expandable tubular member has been described that includes a steel alloy including: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr. In an exemplary embodiment, a yield point of the tubular member is at most about 57.8 ksi prior to a radial expansion and plastic deformation; and the yield point of the tubular member is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, a yield point of the of the tubular member after a radial expansion and plastic deformation is at least about 28 % greater than the yield point of the tubular member prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the tubular member, prior to a radial expansion and plastic deformation, is about 1.04. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00406] An expandable tubular member has been described that includes a steel alloy including: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr. In an exemplary embodiment, the anisotropy of the tubular member, prior to a radial expansion and plastic deformation, is about 1.92. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00407] An expandable tubular member has been described that includes a steel alloy including: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr. In an exemplary embodiment, the anisotropy of the tubular member, prior to a radial expansion and plastic deformation, is about 1.34. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00408] An expandable tubular member has been described, wherein the yield point of the expandable tubular member is at most about 46.9 ksi prior to a radial expansion and plastic deformation; and wherein the yield point of the expandable tubular member is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00409] An expandable tubular member has been described, wherein a yield point of the expandable tubular member after a radial expansion and plastic deformation is at least about 40 % greater than the yield point of the expandable tubular member prior to the radial expansion and plastic deformation. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00410] An expandable tubular member has been described, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at

least about 1.48. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00411] An expandable tubular member has been described, wherein the yield point of the expandable tubular member is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the expandable tubular member is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00412] An expandable tubular member has been described, wherein the yield point of the expandable tubular member after a radial expansion and plastic deformation is at least about 28 % greater than the yield point of the expandable tubular member prior to the radial expansion and plastic deformation. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00413] An expandable tubular member has been described, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.04. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00414] An expandable tubular member has been described, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.92. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00415] An expandable tubular member has been described, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.34. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00416] An expandable tubular member has been described, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00417] An expandable tubular member has been described, wherein the yield point of the expandable tubular member, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00418] An expandable tubular member has been described, wherein the expandability coefficient of the expandable tubular member, prior to the radial expansion and plastic deformation, is greater than 0.12. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00419] An expandable tubular member has been described, wherein the expandability coefficient of the expandable tubular member is greater than the expandability coefficient of another portion of the expandable tubular member. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00420] An expandable tubular member has been described, wherein the tubular member has a higher ductility and a lower yield point prior to a radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00421] A method of radially expanding and plastically deforming a tubular assembly including a first tubular member coupled to a second tubular member has been described that includes radially expanding and plastically deforming the tubular assembly within a preexisting structure; and using less power to radially expand each unit length of the first tubular member than to radially expand each unit length of the second tubular member. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00422] A system for radially expanding and plastically deforming a tubular assembly including a first tubular member coupled to a second tubular member has been described that includes means for radially expanding the tubular assembly within a preexisting structure; and means for using less power to radially expand each unit length of the first tubular member than required to radially expand each unit length of the second tubular member. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00423] A method of manufacturing a tubular member has been described that includes processing a tubular member until the tubular member is characterized by one or more intermediate characteristics; positioning the tubular member within a preexisting structure; and processing the tubular member within the preexisting structure until the tubular member is characterized one or more final characteristics. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support. In an exemplary embodiment, the preexisting structure includes a wellbore that traverses a subterranean formation. In an exemplary embodiment, the characteristics are selected from a group consisting of yield point and ductility. In an exemplary embodiment, processing the tubular member within the preexisting structure until the tubular member is characterized one or more final characteristics includes: radially expanding and plastically deforming the tubular member within the preexisting structure.

[00424] An apparatus has been described that includes an expandable tubular assembly; and an expansion device coupled to the expandable tubular assembly; wherein a

predetermined portion of the expandable tubular assembly has a lower yield point than another portion of the expandable tubular assembly. In an exemplary embodiment, the expansion device includes a rotary expansion device, an axially displaceable expansion device, a reciprocating expansion device, a hydroforming expansion device, and/or an impulsive force expansion device. In an exemplary embodiment, the predetermined portion of the tubular assembly has a higher ductility and a lower yield point than another portion of the expandable tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly has a higher ductility than another portion of the expandable tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly has a lower yield point than another portion of the expandable tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly includes an end portion of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly includes a plurality of predetermined portions of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly includes a plurality of spaced apart predetermined portions of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly includes an end portion of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly includes a plurality of other portions of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly includes a plurality of spaced apart other portions of the tubular assembly. In an exemplary embodiment, the tubular assembly includes a plurality of tubular members coupled to one another by corresponding tubular couplings. In an exemplary embodiment, the tubular couplings comprise the predetermined portions of the tubular assembly; and wherein the tubular members comprise the other portion of the tubular assembly. In an exemplary embodiment, one or more of the tubular couplings comprise the predetermined portions of the tubular assembly. In an exemplary embodiment, one or more of the tubular members comprise the predetermined portions of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly defines one or more openings. In an exemplary embodiment, one or more of the openings comprise slots. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1 In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1. In an exemplary embodiment, the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the predetermined portion of the tubular assembly includes a first steel alloy including: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si,

0.01 % Cu, 0.01 % Ni, and 0.02 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly is about 1.48. In an exemplary embodiment, the predetermined portion of the tubular assembly includes a second steel alloy including: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly is about 1.04. In an exemplary embodiment, the predetermined portion of the tubular assembly includes a third steel alloy including: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly is about 1.92. In an exemplary embodiment, the predetermined portion of the tubular assembly includes a fourth steel alloy including: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly is at least about 1.34. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly is at least about 1.48. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly is at least about 1.04. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly is at least about 1.92. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly is at least about 1.34. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly ranges from about 1.04 to about 1.92. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly ranges from about 47.6 ksi to about 61.7 ksi. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the tubular assembly is greater than the expandability coefficient of the other portion of the tubular assembly. In an exemplary embodiment, the tubular assembly includes a wellbore casing, a pipeline, or a structural support. In an exemplary embodiment, the carbon content of the predetermined portion of the tubular assembly is less than or equal to 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.21. In an exemplary embodiment, the carbon content of the predetermined portion of the tubular assembly is greater than 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less

than 0.36. In an exemplary embodiment, a yield point of an inner tubular portion of at least a portion of the tubular assembly is less than a yield point of an outer tubular portion of the portion of the tubular assembly. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the outer tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the outer tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body. In an exemplary embodiment, the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body. In an exemplary

embodiment, at least a portion of the tubular assembly comprises a microstructure comprising a hard phase structure and a soft phase structure. In an exemplary embodiment, prior to the radial expansion and plastic deformation, at least a portion of the tubular assembly comprises a microstructure comprising a transitional phase structure. In an exemplary embodiment, wherein the hard phase structure comprises martensite. In an exemplary embodiment, wherein the soft phase structure comprises ferrite. In an exemplary embodiment, wherein the transitional phase structure comprises retained austentite. In an exemplary embodiment, the hard phase structure comprises martensite; wherein the soft phase structure comprises ferrite; and wherein the transitional phase structure comprises retained austentite. In an exemplary embodiment, the portion of the tubular assembly comprising a microstructure comprising a hard phase structure and a soft phase structure comprises, by weight percentage, about 0.1% C, about 1.2% Mn, and about 0.3% Si. In an exemplary embodiment, at least a portion of the tubular assembly comprises a microstructure comprising a hard phase structure and a soft phase structure. In an exemplary embodiment, the portion of the tubular assembly comprises, by weight percentage, 0.065% C, 1.44% Mn, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.05% V, 0.01% Mo, 0.01% Nb, and 0.01%Ti. In an exemplary embodiment, the portion of the tubular assembly comprises, by weight percentage, 0.18% C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.04% V, 0.01% Mo, 0.03% Nb, and 0.01%Ti. In an exemplary embodiment, the portion of the tubular assembly comprises, by weight percentage, 0.08% C, 0.82% Mn, 0.006% P, 0.003% S, 0.30% Si, 0.06% Cu, 0.05% Ni, 0.05% Cr, 0.03% V, 0.03% Mo, 0.01% Nb, and 0.01%Ti. In an exemplary embodiment, the portion of the tubular assembly comprises a microstructure comprising one or more of the following: martensite, pearlite, vanadium carbide, nickel carbide, or titanium carbide. In an exemplary embodiment, the portion of the tubular assembly comprises a microstructure comprising one or more of the following: pearlite or pearlite striation. In an exemplary embodiment, the portion of the tubular assembly comprises a microstructure comprising one or more of the following: grain pearlite, widmanstatten martensite, vanadium carbide, nickel carbide, or titanium carbide. In an exemplary embodiment, the portion of the tubular assembly comprises a microstructure comprising one or more of the following: ferrite, grain pearlite, or martensite. In an exemplary embodiment, the portion of the tubular assembly comprises a microstructure comprising one or more of the following: ferrite, martensite, or bainite. In an exemplary embodiment, the portion of the tubular assembly comprises a microstructure comprising one or more of the following: bainite, pearlite, or ferrite. In an exemplary embodiment, the portion of the tubular assembly comprises a yield strength of about 67ksi and a tensile strength of about 95 ksi. In an exemplary embodiment, the portion of the tubular assembly comprises a

yield strength of about 82 ksi and a tensile strength of about 130 ksi. In an exemplary embodiment, the portion of the tubular assembly comprises a yield strength of about 60 ksi and a tensile strength of about 97 ksi.

[00425] An expandable tubular member has been described, wherein a yield point of the expandable tubular member after a radial expansion and plastic deformation is at least about 5.8 % greater than the yield point of the expandable tubular member prior to the radial expansion and plastic deformation. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00426] A method of determining the expandability of a selected tubular member has been described that includes determining an anisotropy value for the selected tubular member, determining a strain hardening value for the selected tubular member; and multiplying the anisotropy value times the strain hardening value to generate an expandability value for the selected tubular member. In an exemplary embodiment, an anisotropy value greater than 0.12 indicates that the tubular member is suitable for radial expansion and plastic deformation. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support.

[00427] A method of radially expanding and plastically deforming tubular members has been described that includes selecting a tubular member; determining an anisotropy value for the selected tubular member; determining a strain hardening value for the selected tubular member; multiplying the anisotropy value times the strain hardening value to generate an expandability value for the selected tubular member; and if the anisotropy value is greater than 0.12, then radially expanding and plastically deforming the selected tubular member. In an exemplary embodiment, the tubular member includes a wellbore casing, a pipeline, or a structural support. In an exemplary embodiment, radially expanding and plastically deforming the selected tubular member includes: inserting the selected tubular member into a preexisting structure; and then radially expanding and plastically deforming the selected tubular member. In an exemplary embodiment, the preexisting structure includes a wellbore that traverses a subterranean formation.

[00428] A radially expandable multiple tubular member apparatus has been described that includes a first tubular member; a second tubular member engaged with the first tubular member forming a joint; a sleeve overlapping and coupling the first and second tubular members at the joint; the sleeve having opposite tapered ends and a flange engaged in a recess formed in an adjacent tubular member; and one of the tapered ends being a surface formed on the flange. In an exemplary embodiment, the recess includes a tapered wall in mating engagement with the tapered end formed on the flange. In an exemplary embodiment, the sleeve includes a flange at each tapered end and each tapered end is formed on a respective flange. In an exemplary embodiment, each tubular member includes

a recess. In an exemplary embodiment, each flange is engaged in a respective one of the recesses. In an exemplary embodiment, each recess includes a tapered wall in mating engagement with the tapered end formed on a respective one of the flanges.

[00429] A method of joining radially expandable multiple tubular members has also been described that includes providing a first tubular member; engaging a second tubular member with the first tubular member to form a joint; providing a sleeve having opposite tapered ends and a flange, one of the tapered ends being a surface formed on the flange; and mounting the sleeve for overlapping and coupling the first and second tubular members at the joint, wherein the flange is engaged in a recess formed in an adjacent one of the tubular members. In an exemplary embodiment, the method further includes providing a tapered wall in the recess for mating engagement with the tapered end formed on the flange. In an exemplary embodiment, the method further includes providing a flange at each tapered end wherein each tapered end is formed on a respective flange. In an exemplary embodiment, the method further includes providing a recess in each tubular member. In an exemplary embodiment, the method further includes engaging each flange in a respective one of the recesses. In an exemplary embodiment, the method further includes providing a tapered wall in each recess for mating engagement with the tapered end formed on a respective one of the flanges.

[00430] A radially expandable multiple tubular member apparatus has been described that includes a first tubular member; a second tubular member engaged with the first tubular member forming a joint; and a sleeve overlapping and coupling the first and second tubular members at the joint; wherein at least a portion of the sleeve is comprised of a frangible material.

[00431] A radially expandable multiple tubular member apparatus has been described that includes a first tubular member; a second tubular member engaged with the first tubular member forming a joint; and a sleeve overlapping and coupling the first and second tubular members at the joint; wherein the wall thickness of the sleeve is variable.

[00432] A method of joining radially expandable multiple tubular members has been described that includes providing a first tubular member; engaging a second tubular member with the first tubular member to form a joint; providing a sleeve comprising a frangible material; and mounting the sleeve for overlapping and coupling the first and second tubular members at the joint.

[00433] A method of joining radially expandable multiple tubular members has been described that includes providing a first tubular member; engaging a second tubular member with the first tubular member to form a joint; providing a sleeve comprising a variable wall thickness; and mounting the sleeve for overlapping and coupling the first and second tubular members at the joint.

[00434] An expandable tubular assembly has been described that includes a first tubular member; a second tubular member coupled to the first tubular member; and means for increasing the axial compression loading capacity of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members.

[00435] An expandable tubular assembly has been described that includes a first tubular member; a second tubular member coupled to the first tubular member; and means for increasing the axial tension loading capacity of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members.

[00436] An expandable tubular assembly has been described that includes a first tubular member; a second tubular member coupled to the first tubular member; and means for increasing the axial compression and tension loading capacity of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members.

[00437] An expandable tubular assembly has been described that includes a first tubular member; a second tubular member coupled to the first tubular member; and means for avoiding stress risers in the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members.

[00438] An expandable tubular assembly has been described that includes a first tubular member; a second tubular member coupled to the first tubular member; and means for inducing stresses at selected portions of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members.

[00439] In several exemplary embodiments of the apparatus described above, the sleeve is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed.

[00440] In several exemplary embodiments of the method described above, the method further includes maintaining the sleeve in circumferential tension; and maintaining the first and second tubular members in circumferential compression before, during, and/or after the radial expansion and plastic deformation of the first and second tubular members.

[00441] An expandable tubular assembly has been described that includes a first tubular member, a second tubular member coupled to the first tubular member, a first threaded connection for coupling a portion of the first and second tubular members, a second threaded connection spaced apart from the first threaded connection for coupling another portion of the first and second tubular members, a tubular sleeve coupled to and

receiving end portions of the first and second tubular members, and a sealing element positioned between the first and second spaced apart threaded connections for sealing an interface between the first and second tubular member, wherein the sealing element is positioned within an annulus defined between the first and second tubular members. In an exemplary embodiment, the annulus is at least partially defined by an irregular surface. In an exemplary embodiment, the annulus is at least partially defined by a toothed surface. In an exemplary embodiment, the sealing element comprises an elastomeric material. In an exemplary embodiment, the sealing element comprises a metallic material. In an exemplary embodiment, the sealing element comprises an elastomeric and a metallic material.

[00442] A method of joining radially expandable multiple tubular members has been described that includes providing a first tubular member, providing a second tubular member, providing a sleeve, mounting the sleeve for overlapping and coupling the first and second tubular members, threadably coupling the first and second tubular members at a first location, threadably coupling the first and second tubular members at a second location spaced apart from the first location, and sealing an interface between the first and second tubular members between the first and second locations using a compressible sealing element. In an exemplary embodiment, the sealing element includes an irregular surface. In an exemplary embodiment, the sealing element includes a toothed surface. In an exemplary embodiment, the sealing element comprises an elastomeric material. In an exemplary embodiment, the sealing element comprises a metallic material. In an exemplary embodiment, the sealing element comprises an elastomeric and a metallic material.

[00443] An expandable tubular assembly has been described that includes a first tubular member, a second tubular member coupled to the first tubular member, a first threaded connection for coupling a portion of the first and second tubular members, a second threaded connection spaced apart from the first threaded connection for coupling another portion of the first and second tubular members, and a plurality of spaced apart tubular sleeves coupled to and receiving end portions of the first and second tubular members. In an exemplary embodiment, at least one of the tubular sleeves is positioned in opposing relation to the first threaded connection; and wherein at least one of the tubular sleeves is positioned in opposing relation to the second threaded connection. In an exemplary embodiment, at least one of the tubular sleeves is not positioned in opposing relation to the first and second threaded connections.

[00444] A method of joining radially expandable multiple tubular members has been described that includes providing a first tubular member, providing a second tubular member, threadably coupling the first and second tubular members at a first location, threadably coupling the first and second tubular members at a second location spaced apart from the first location, providing a plurality of sleeves, and mounting the sleeves at spaced

apart locations for overlapping and coupling the first and second tubular members. In an exemplary embodiment, at least one of the tubular sleeves is positioned in opposing relation to the first threaded coupling; and wherein at least one of the tubular sleeves is positioned in opposing relation to the second threaded coupling. In an exemplary embodiment, at least one of the tubular sleeves is not positioned in opposing relation to the first and second threaded couplings.

[00445] An expandable tubular assembly has been described that includes a first tubular member, a second tubular member coupled to the first tubular member, and a plurality of spaced apart tubular sleeves coupled to and receiving end portions of the first and second tubular members.

[00446] A method of joining radially expandable multiple tubular members has been described that includes providing a first tubular member, providing a second tubular member, providing a plurality of sleeves, coupling the first and second tubular members, and mounting the sleeves at spaced apart locations for overlapping and coupling the first and second tubular members.

[00447] An expandable tubular assembly has been described that includes a first tubular member, a second tubular member coupled to the first tubular member, a threaded connection for coupling a portion of the first and second tubular members, and a tubular sleeves coupled to and receiving end portions of the first and second tubular members, wherein at least a portion of the threaded connection is upset. In an exemplary embodiment, at least a portion of tubular sleeve penetrates the first tubular member.

[00448] A method of joining radially expandable multiple tubular members has been described that includes providing a first tubular member, providing a second tubular member, threadably coupling the first and second tubular members, and upsetting the threaded coupling. In an exemplary embodiment, the first tubular member further comprises an annular extension extending therefrom, and the flange of the sleeve defines an annular recess for receiving and mating with the annular extension of the first tubular member. In an exemplary embodiment, the first tubular member further comprises an annular extension extending therefrom; and the flange of the sleeve defines an annular recess for receiving and mating with the annular extension of the first tubular member.

[00449] A radially expandable multiple tubular member apparatus has been described that includes a first tubular member, a second tubular member engaged with the first tubular member forming a joint, a sleeve overlapping and coupling the first and second tubular members at the joint, and one or more stress concentrators for concentrating stresses in the joint. In an exemplary embodiment, one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member. In an exemplary embodiment, one or more of the stress concentrators comprises one or more internal grooves defined in

the second tubular member. In an exemplary embodiment, one or more of the stress concentrators comprises one or more openings defined in the sleeve. In an exemplary embodiment, one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member; and one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member. In an exemplary embodiment, one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member; and one or more of the stress concentrators comprises one or more openings defined in the sleeve. In an exemplary embodiment, one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member; and one or more of the stress concentrators comprises one or more openings defined in the sleeve. In an exemplary embodiment, one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member; wherein one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member; and wherein one or more of the stress concentrators comprises one or more openings defined in the sleeve.

[00450] A method of joining radially expandable multiple tubular members has been described that includes providing a first tubular member, engaging a second tubular member with the first tubular member to form a joint, providing a sleeve having opposite tapered ends and a flange, one of the tapered ends being a surface formed on the flange, and concentrating stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the first tubular member to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the second tubular member to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the sleeve to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the first tubular member and the second tubular member to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the first tubular member and the sleeve to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the second tubular member and the sleeve to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the first tubular member, the second tubular member, and the sleeve to concentrate stresses within the joint.

[00451] A system for radially expanding and plastically deforming a first tubular member coupled to a second tubular member by a mechanical connection has been described that includes means for radially expanding the first and second tubular members, and means for maintaining portions of the first and second tubular member in circumferential

compression following the radial expansion and plastic deformation of the first and second tubular members.

[00452] A system for radially expanding and plastically deforming a first tubular member coupled to a second tubular member by a mechanical connection has been described that includes means for radially expanding the first and second tubular members; and means for concentrating stresses within the mechanical connection during the radial expansion and plastic deformation of the first and second tubular members.

[00453] A system for radially expanding and plastically deforming a first tubular member coupled to a second tubular member by a mechanical connection has been described that includes means for radially expanding the first and second tubular members; means for maintaining portions of the first and second tubular member in circumferential compression following the radial expansion and plastic deformation of the first and second tubular members; and means for concentrating stresses within the mechanical connection during the radial expansion and plastic deformation of the first and second tubular members.

[00454] A radially expandable tubular member apparatus has been described that includes a first tubular member; a second tubular member engaged with the first tubular member forming a joint; and a sleeve overlapping and coupling the first and second tubular members at the joint; wherein, prior to a radial expansion and plastic deformation of the apparatus, a predetermined portion of the apparatus has a lower yield point than another portion of the apparatus. In an exemplary embodiment, the carbon content of the predetermined portion of the apparatus is less than or equal to 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the apparatus is less than 0.21. In an exemplary embodiment, the carbon content of the predetermined portion of the apparatus is greater than 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the apparatus is less than 0.36. In an exemplary embodiment, the apparatus further includes means for maintaining portions of the first and second tubular member in circumferential compression following the radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the apparatus further includes means for concentrating stresses within the mechanical connection during the radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the apparatus further includes means for maintaining portions of the first and second tubular member in circumferential compression following the radial expansion and plastic deformation of the first and second tubular members; and means for concentrating stresses within the mechanical connection during the radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the apparatus further includes one or more stress concentrators for concentrating stresses in the joint. In an exemplary embodiment, one or more of the stress

concentrators comprises one or more external grooves defined in the first tubular member. In an exemplary embodiment, one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member. In an exemplary embodiment, one or more of the stress concentrators comprises one or more openings defined in the sleeve. In an exemplary embodiment, one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member; and wherein one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member. In an exemplary embodiment, one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member; and wherein one or more of the stress concentrators comprises one or more openings defined in the sleeve. In an exemplary embodiment, one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member; and wherein one or more of the stress concentrators comprises one or more openings defined in the sleeve. In an exemplary embodiment, one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member; wherein one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member; and wherein one or more of the stress concentrators comprises one or more openings defined in the sleeve. In an exemplary embodiment, the first tubular member further comprises an annular extension extending therefrom; and wherein the flange of the sleeve defines an annular recess for receiving and mating with the annular extension of the first tubular member. In an exemplary embodiment, the apparatus further includes a threaded connection for coupling a portion of the first and second tubular members; wherein at least a portion of the threaded connection is upset. In an exemplary embodiment, at least a portion of tubular sleeve penetrates the first tubular member. In an exemplary embodiment, the apparatus further includes means for increasing the axial compression loading capacity of the joint between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the apparatus further includes means for increasing the axial tension loading capacity of the joint between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the apparatus further includes means for increasing the axial compression and tension loading capacity of the joint between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the apparatus further includes means for avoiding stress risers in the joint between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the apparatus further includes means for

inducing stresses at selected portions of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the sleeve is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed. In an exemplary embodiment, the means for increasing the axial compression loading capacity of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed. In an exemplary embodiment, the means for increasing the axial tension loading capacity of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed. In an exemplary embodiment, the means for increasing the axial compression and tension loading capacity of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed. In an exemplary embodiment, the means for avoiding stress risers in the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed. In an exemplary embodiment, the means for inducing stresses at selected portions of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed. In an exemplary embodiment, at least a portion of the sleeve is comprised of a frangible material. In an exemplary embodiment, the wall thickness of the sleeve is variable. In an exemplary embodiment, the predetermined portion of the apparatus has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the apparatus has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the apparatus has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the apparatus has a larger inside diameter after the radial expansion and plastic deformation than other portions of the tubular assembly. In an exemplary embodiment, the sleeve is circumferentially tensioned; and wherein the first and

second tubular members are circumferentially compressed. In an exemplary embodiment, the sleeve is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed. In an exemplary embodiment, the apparatus further includes positioning another apparatus within the preexisting structure in overlapping relation to the apparatus; and radially expanding and plastically deforming the other apparatus within the preexisting structure; wherein, prior to the radial expansion and plastic deformation of the apparatus, a predetermined portion of the other apparatus has a lower yield point than another portion of the other apparatus. In an exemplary embodiment, the inside diameter of the radially expanded and plastically deformed other portion of the apparatus is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other apparatus. In an exemplary embodiment, the predetermined portion of the apparatus comprises an end portion of the apparatus. In an exemplary embodiment, the predetermined portion of the apparatus comprises a plurality of predetermined portions of the apparatus. In an exemplary embodiment, the predetermined portion of the apparatus comprises a plurality of spaced apart predetermined portions of the apparatus. In an exemplary embodiment, the other portion of the apparatus comprises an end portion of the apparatus. In an exemplary embodiment, the other portion of the apparatus comprises a plurality of other portions of the apparatus. In an exemplary embodiment, the other portion of the apparatus comprises a plurality of spaced apart other portions of the apparatus. In an exemplary embodiment, the apparatus comprises a plurality of tubular members coupled to one another by corresponding tubular couplings. In an exemplary embodiment, the tubular couplings comprise the predetermined portions of the apparatus; and wherein the tubular members comprise the other portion of the apparatus. In an exemplary embodiment, one or more of the tubular couplings comprise the predetermined portions of the apparatus. In an exemplary embodiment, one or more of the tubular members comprise the predetermined portions of the apparatus. In an exemplary embodiment, the predetermined portion of the apparatus defines one or more openings. In an exemplary embodiment, one or more of the openings comprise slots. In an exemplary embodiment, the anisotropy for the predetermined portion of the apparatus is greater than 1. In an exemplary embodiment, the anisotropy for the predetermined portion of the apparatus is greater than 1. In an exemplary embodiment, the strain hardening exponent for the predetermined portion of the apparatus is greater than 0.12. In an exemplary embodiment, the anisotropy for the predetermined portion of the apparatus is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the apparatus is greater than 0.12. In an exemplary embodiment, the predetermined portion of the apparatus comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus is at

most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.48. In an exemplary embodiment, the predetermined portion of the apparatus comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.04. In an exemplary embodiment, the predetermined portion of the apparatus comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.92. In an exemplary embodiment, the predetermined portion of the apparatus comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.34. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.48. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus is at most about 57.8 ksi prior to the radial expansion

and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.04. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.92. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.34. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is greater than 0.12. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the apparatus is greater than the expandability coefficient of the other portion of the apparatus. In an exemplary embodiment, the apparatus comprises a wellbore casing. In an exemplary embodiment, the apparatus comprises a pipeline. In an exemplary embodiment, the apparatus comprises a structural support.

[00455] A radially expandable tubular member apparatus has been described that includes a first tubular member; a second tubular member engaged with the first tubular member forming a joint; a sleeve overlapping and coupling the first and second tubular members at the joint; the sleeve having opposite tapered ends and a flange engaged in a recess formed in an adjacent tubular member; and one of the tapered ends being a surface formed on the flange; wherein, prior to a radial expansion and plastic deformation of the apparatus, a predetermined portion of the apparatus has a lower yield point than another portion of the apparatus. In an exemplary embodiment, the recess includes a tapered wall in mating engagement with the tapered end formed on the flange. In an exemplary embodiment, the sleeve includes a flange at each tapered end and each tapered end is formed on a respective flange. In an exemplary embodiment, each tubular member includes a recess. In an exemplary embodiment, each flange is engaged in a respective one of the recesses. In an exemplary embodiment, each recess includes a tapered wall in mating engagement with the tapered end formed on a respective one of the flanges. In an exemplary embodiment, the predetermined portion of the apparatus has a higher ductility

and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the apparatus has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the apparatus has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the apparatus has a larger inside diameter after the radial expansion and plastic deformation than other portions of the tubular assembly. In an exemplary embodiment, the apparatus further includes positioning another apparatus within the preexisting structure in overlapping relation to the apparatus; and radially expanding and plastically deforming the other apparatus within the preexisting structure; wherein, prior to the radial expansion and plastic deformation of the apparatus, a predetermined portion of the other apparatus has a lower yield point than another portion of the other apparatus. In an exemplary embodiment, the inside diameter of the radially expanded and plastically deformed other portion of the apparatus is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other apparatus. In an exemplary embodiment, the predetermined portion of the apparatus comprises an end portion of the apparatus. In an exemplary embodiment, the predetermined portion of the apparatus comprises a plurality of predetermined portions of the apparatus. In an exemplary embodiment, the predetermined portion of the apparatus comprises a plurality of spaced apart predetermined portions of the apparatus. In an exemplary embodiment, the other portion of the apparatus comprises an end portion of the apparatus. In an exemplary embodiment, the other portion of the apparatus comprises a plurality of other portions of the apparatus. In an exemplary embodiment, the other portion of the apparatus comprises a plurality of spaced apart other portions of the apparatus. In an exemplary embodiment, the apparatus comprises a plurality of tubular members coupled to one another by corresponding tubular couplings. In an exemplary embodiment, the tubular couplings comprise the predetermined portions of the apparatus; and wherein the tubular members comprise the other portion of the apparatus. In an exemplary embodiment, one or more of the tubular couplings comprise the predetermined portions of the apparatus. In an exemplary embodiment, one or more of the tubular members comprise the predetermined portions of the apparatus. In an exemplary embodiment, the predetermined portion of the apparatus defines one or more openings. In an exemplary embodiment, one or more of the openings comprise slots. In an exemplary embodiment, the anisotropy for the predetermined portion of the apparatus is greater than 1. In an exemplary embodiment, the anisotropy for the predetermined portion of the apparatus is greater than 1. In an exemplary embodiment, the strain hardening exponent for the predetermined portion of the apparatus is

greater than 0.12. In an exemplary embodiment, the anisotropy for the predetermined portion of the apparatus is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the apparatus is greater than 0.12. In an exemplary embodiment, the predetermined portion of the apparatus comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.48. In an exemplary embodiment, the predetermined portion of the apparatus comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.04. In an exemplary embodiment, the predetermined portion of the apparatus comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.92. In an exemplary embodiment, the predetermined portion of the apparatus comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.34. In an exemplary embodiment, the yield point of the predetermined portion of the âpparatus is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of

the apparatus after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.48. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.04. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.92. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.34. In an exemplary embodiment, the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92. In an exemplary embodiment, the yield point of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is greater than 0.12. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the apparatus is greater than the expandability coefficient of the other portion of the apparatus. In an exemplary embodiment, the apparatus comprises a wellbore casing. In an exemplary embodiment, the apparatus comprises a pipeline. In an exemplary embodiment, the apparatus comprises a structural support.

[00456] A method of joining radially expandable tubular members has been provided that includes: providing a first tubular member; engaging a second tubular member with the first tubular member to form a joint; providing a sleeve; mounting the sleeve for overlapping and coupling the first and second tubular members at the joint; wherein the first tubular member, the second tubular member, and the sleeve define a tubular assembly; and radially expanding and plastically deforming the tubular assembly; wherein, prior to the radial expansion and plastic deformation, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly. In an exemplary embodiment, the carbon content of the predetermined portion of the tubular assembly is less than or equal

to 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.21. In an exemplary embodiment, the carbon content of the predetermined portion of the tubular assembly is greater than 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.36. In an exemplary embodiment, the method further includes: maintaining portions of the first and second tubular member in circumferential compression following a radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the method further includes: concentrating stresses within the joint during a radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the method further includes: maintaining portions of the first and second tubular member in circumferential compression following a radial expansion and plastic deformation of the first and second tubular members; and concentrating stresses within the joint during a radial expansion and plastic deformation of the first and second tubular members. In an exemplary embodiment, the method further includes: concentrating stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the first tubular member to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the second tubular member to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the sleeve to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the first tubular member and the second tubular member to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the first tubular member and the sleeve to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the second tubular member and the sleeve to concentrate stresses within the joint. In an exemplary embodiment, concentrating stresses within the joint comprises using the first tubular member, the second tubular member, and the sleeve to concentrate stresses within the joint. In an exemplary embodiment, at least a portion of the sleeve is comprised of a frangible material. In an exemplary embodiment, the sleeve comprises a variable wall thickness. In an exemplary embodiment, the method further includes maintaining the sleeve in circumferential tension; and maintaining the first and second tubular members in circumferential compression. In an exemplary embodiment, the method further includes maintaining the sleeve in circumferential tension; and maintaining the first and second tubular members in circumferential compression. In an exemplary embodiment, the method further includes: maintaining the sleeve in circumferential tension; and maintaining the first and second tubular members in circumferential compression. In an exemplary embodiment, the method further includes: threadably coupling the first and second tubular members at a

first location; threadably coupling the first and second tubular members at a second location spaced apart from the first location; providing a plurality of sleeves; and mounting the sleeves at spaced apart locations for overlapping and coupling the first and second tubular members. In an exemplary embodiment, at least one of the tubular sleeves is positioned in opposing relation to the first threaded coupling; and wherein at least one of the tubular sleeves is positioned in opposing relation to the second threaded coupling. In an exemplary embodiment, at least one of the tubular sleeves is not positioned in opposing relation to the first and second threaded couplings. In an exemplary embodiment, the method further includes: threadably coupling the first and second tubular members; and upsetting the threaded coupling. In an exemplary embodiment, the first tubular member further comprises an annular extension extending therefrom; and wherein the flange of the sleeve defines an annular recess for receiving and mating with the annular extension of the first tubular member. In an exemplary embodiment, the predetermined portion of the tubular assembly has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a larger inside diameter after the radial expansion and plastic deformation than the other portion of the tubular assembly. In an exemplary embodiment, the method further includes: positioning another tubular assembly within the preexisting structure in overlapping relation to the tubular assembly; and radially expanding and plastically deforming the other tubular assembly within the preexisting structure; wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the other tubular assembly has a lower yield point than another portion of the other tubular assembly. In an exemplary embodiment, the inside diameter of the radially expanded and plastically deformed other portion of the tubular assembly is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises an end portion of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a plurality of predetermined portions of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a plurality of spaced apart predetermined portions of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly comprises an end portion of the tubular assembly.

In an exemplary embodiment, the other portion of the tubular assembly comprises a plurality of other portions of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly comprises a plurality of spaced apart other portions of the tubular assembly. In an exemplary embodiment, the tubular assembly comprises a plurality of tubular members coupled to one another by corresponding tubular couplings. In an exemplary embodiment, the tubular couplings comprise the predetermined portions of the tubular assembly; and wherein the tubular members comprise the other portion of the tubular assembly. In an exemplary embodiment, one or more of the tubular couplings comprise the predetermined portions of the tubular assembly. In an exemplary embodiment, one or more of the tubular members comprise the predetermined portions of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly defines one or more openings. In an exemplary embodiment, one or more of the openings comprise slots. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1. In an exemplary embodiment, the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.48. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of

the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.04. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.92. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.34. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.48. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.04. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.92. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.34. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about

1.04 to about 1.92. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is greater than 0.12. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the tubular assembly is greater than the expandability coefficient of the other portion of the tubular assembly. In an exemplary embodiment, the tubular assembly comprises a wellbore casing. In an exemplary embodiment, the tubular assembly comprises a pipeline. In an exemplary embodiment, the tubular assembly comprises a structural support.

[00457] A method of joining radially expandable tubular members has been described that includes: providing a first tubular member; engaging a second tubular member with the first tubular member to form a joint; providing a sleeve having opposite tapered ends and a flange, one of the tapered ends being a surface formed on the flange; mounting the sleeve for overlapping and coupling the first and second tubular members at the joint, wherein the flange is engaged in a recess formed in an adjacent one of the tubular members; wherein the first tubular member, the second tubular member, and the sleeve define a tubular assembly; and radially expanding and plastically deforming the tubular assembly; wherein, prior to the radial expansion and plastic deformation, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly. In an exemplary embodiment, the method further includes: providing a tapered wall in the recess for mating engagement with the tapered end formed on the flange. In an exemplary embodiment, the method further includes: providing a flange at each tapered end wherein each tapered end is formed on a respective flange. In an exemplary embodiment, the method further includes: providing a recess in each tubular member. In an exemplary embodiment, the method further includes: engaging each flange in a respective one of the recesses. In an exemplary embodiment, the method further includes: providing a tapered wall in each recess for mating engagement with the tapered end formed on a respective one of the flanges. In an exemplary embodiment, the predetermined portion of the tubular assembly has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a larger inside diameter after the radial

expansion and plastic deformation than the other portion of the tubular assembly. In an exemplary embodiment, the method further includes: positioning another tubular assembly within the preexisting structure in overlapping relation to the tubular assembly; and radially expanding and plastically deforming the other tubular assembly within the preexisting structure; wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the other tubular assembly has a lower yield point than another portion of the other tubular assembly. In an exemplary embodiment, the inside diameter of the radially expanded and plastically deformed other portion of the tubular assembly is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises an end portion of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a plurality of predetermined portions of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a plurality of spaced apart predetermined portions of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly comprises an end portion of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly comprises a plurality of other portions of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly comprises a plurality of spaced apart other portions of the tubular assembly. In an exemplary embodiment, the tubular assembly comprises a plurality of tubular members coupled to one another by corresponding tubular couplings. In an exemplary embodiment, the tubular couplings comprise the predetermined portions of the tubular assembly; and wherein the tubular members comprise the other portion of the tubular assembly. In an exemplary embodiment, one or more of the tubular couplings comprise the predetermined portions of the tubular assembly. In an exemplary embodiment, one or more of the tubular members comprise the predetermined portions of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly defines one or more openings. In an exemplary embodiment, one or more of the openings comprise slots. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1. In an exemplary embodiment, the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24

% Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.48. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.04. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.92. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.34. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined

portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.48. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.04. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.92. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.34. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is greater than 0.12. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the tubular assembly is greater than the expandability coefficient of the other portion of the tubular assembly. In an exemplary embodiment, the tubular assembly comprises a wellbore casing. In an exemplary embodiment, the tubular assembly comprises a pipeline. In an exemplary embodiment, the tubular assembly comprises a structural support.

[00458] An expandable tubular assembly has been described that includes a first tubular member; a second tubular member coupled to the first tubular member; a first threaded connection for coupling a portion of the first and second tubular members; a second threaded connection spaced apart from the first threaded connection for coupling another portion of the first and second tubular members; a tubular sleeve coupled to and receiving end portions of the first and second tubular members; and a sealing element positioned between the first and second spaced apart threaded connections for sealing an interface between the first and second tubular member; wherein the sealing element is positioned within an annulus defined between the first and second tubular members; and wherein, prior to a radial expansion and plastic deformation of the assembly, a predetermined portion of the assembly has a lower yield point than another portion of the

apparatus. In an exemplary embodiment, the predetermined portion of the assembly has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the assembly has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the assembly has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the assembly has a larger inside diameter after the radial expansion and plastic deformation than other portions of the tubular assembly. In an exemplary embodiment, the assembly further includes: positioning another assembly within the preexisting structure in overlapping relation to the assembly; and radially expanding and plastically deforming the other assembly within the preexisting structure; wherein, prior to the radial expansion and plastic deformation of the assembly, a predetermined portion of the other assembly has a lower yield point than another portion of the other assembly. In an exemplary embodiment, the inside diameter of the radially expanded and plastically deformed other portion of the assembly is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other assembly. In an exemplary embodiment, the predetermined portion of the assembly comprises an end portion of the assembly. In an exemplary embodiment, the predetermined portion of the assembly comprises a plurality of predetermined portions of the assembly. In an exemplary embodiment, the predetermined portion of the assembly comprises a plurality of spaced apart predetermined portions of the assembly. In an exemplary embodiment, the other portion of the assembly comprises an end portion of the assembly. In an exemplary embodiment, the other portion of the assembly comprises a plurality of other portions of the assembly. In an exemplary embodiment, the other portion of the assembly comprises a plurality of spaced apart other portions of the assembly. In an exemplary embodiment, the assembly comprises a plurality of tubular members coupled to one another by corresponding tubular couplings. In an exemplary embodiment, the tubular couplings comprise the predetermined portions of the assembly; and wherein the tubular members comprise the other portion of the assembly. In an exemplary embodiment, one or more of the tubular couplings comprise the predetermined portions of the assembly. In an exemplary embodiment, one or more of the tubular members comprise the predetermined portions of the assembly. In an exemplary embodiment, the predetermined portion of the assembly defines one or more openings. In an exemplary embodiment, one or more of the openings comprise slots. In an exemplary embodiment, the anisotropy for the predetermined portion of the assembly is greater than 1. In an exemplary embodiment, the anisotropy for the predetermined portion of the assembly is greater than 1. In an exemplary embodiment, the

strain hardening exponent for the predetermined portion of the assembly is greater than 0.12. In an exemplary embodiment, the anisotropy for the predetermined portion of the assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the assembly is greater than 0.12. In an exemplary embodiment, the predetermined portion of the assembly comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the assembly is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is about 1.48. In an exemplary embodiment, the predetermined portion of the assembly comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the assembly is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is about 1.04. In an exemplary embodiment, the predetermined portion of the assembly comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is about 1.92. In an exemplary embodiment, the predetermined portion of the assembly comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is about 1.34. In an exemplary embodiment, the yield point of the predetermined portion of the assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the assembly is at least about 65.9 ksi after the radial expansion and plastic

deformation. In an exemplary embodiment, the yield point of the predetermined portion of the assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is at least about 1.48. In an exemplary embodiment, the yield point of the predetermined portion of the assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the assembly is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is at least about 1.04. In an exemplary embodiment, the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is at least about 1.92. In an exemplary embodiment, the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is at least about 1.34. In an exemplary embodiment, the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92. In an exemplary embodiment, the yield point of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is greater than 0.12. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the assembly is greater than the expandability coefficient of the other portion of the assembly. In an exemplary embodiment, the assembly comprises a wellbore casing. In an exemplary embodiment, the assembly comprises a pipeline. In an exemplary embodiment, the assembly comprises a structural support. In an exemplary embodiment, the annulus is at least partially defined by an irregular surface. In an exemplary embodiment, the annulus is at least partially defined by a toothed surface. In an exemplary embodiment, the sealing element comprises an elastomeric material. In an exemplary embodiment, the sealing element comprises a metallic material. In an exemplary embodiment, the sealing element comprises an elastomeric and a metallic material.

[00459] A method of joining radially expandable tubular members is provided that includes providing a first tubular member; providing a second tubular member; providing a sleeve; mounting the sleeve for overlapping and coupling the first and second tubular

members; threadably coupling the first and second tubular members at a first location; threadably coupling the first and second tubular members at a second location spaced apart from the first location; sealing an interface between the first and second tubular members between the first and second locations using a compressible sealing element, wherein the first tubular member, second tubular member, sleeve, and the sealing element define a tubular assembly; and radially expanding and plastically deforming the tubular assembly; wherein, prior to the radial expansion and plastic deformation, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly. In an exemplary embodiment, the sealing element includes an irregular surface. In an exemplary embodiment, the sealing element includes a toothed surface. In an exemplary embodiment, the sealing element comprises an elastomeric material. In an exemplary embodiment, the sealing element comprises a metallic material. In an exemplary embodiment, the sealing element comprises an elastomeric and a metallic material. In an exemplary embodiment, the predetermined portion of the tubular assembly has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation. In an exemplary embodiment, the predetermined portion of the tubular assembly has a larger inside diameter after the radial expansion and plastic deformation than the other portion of the tubular assembly. In an exemplary embodiment, the method further includes: positioning another tubular assembly within the preexisting structure in overlapping relation to the tubular assembly; and radially expanding and plastically deforming the other tubular assembly within the preexisting structure; wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the other tubular assembly has a lower yield point than another portion of the other tubular assembly. In an exemplary embodiment, the inside diameter of the radially expanded and plastically deformed other portion of the tubular assembly is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises an end portion of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a plurality of predetermined portions of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a plurality of spaced apart predetermined portions of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly comprises an end portion of the

tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly comprises a plurality of other portions of the tubular assembly. In an exemplary embodiment, the other portion of the tubular assembly comprises a plurality of spaced apart other portions of the tubular assembly. In an exemplary embodiment, the tubular assembly comprises a plurality of tubular members coupled to one another by corresponding tubular couplings. In an exemplary embodiment, the tubular couplings comprise the predetermined portions of the tubular assembly; and wherein the tubular members comprise the other portion of the tubular assembly. In an exemplary embodiment, one or more of the tubular couplings comprise the predetermined portions of the tubular assembly. In an exemplary embodiment, one or more of the tubular members comprise the predetermined portions of the tubular assembly. In an exemplary embodiment, the predetermined portion of the tubular assembly defines one or more openings. In an exemplary embodiment, one or more of the openings comprise slots. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1. In an exemplary embodiment, the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the anisotropy for the predetermined portion of the tubular assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.48. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation. In an

exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.04. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.92. In an exemplary embodiment, the predetermined portion of the tubular assembly comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.34. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.48. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.04. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.92. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.34. In an exemplary embodiment, the anisotropy of the predetermined portion of the tubular assembly, prior to

the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92. In an exemplary embodiment, the yield point of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is greater than 0.12. In an exemplary embodiment, the expandability coefficient of the predetermined portion of the tubular assembly is greater than the expandability coefficient of the other portion of the tubular assembly. In an exemplary embodiment, the tubular assembly comprises a wellbore casing. In an exemplary embodiment, the tubular assembly comprises a pipeline. In an exemplary embodiment, the tubular assembly comprises a structural support. In an exemplary embodiment, the sleeve comprises: a plurality of spaced apart tubular sleeves coupled to and receiving end portions of the first and second tubular members. In an exemplary embodiment, the first tubular member comprises a first threaded connection; wherein the second tubular member comprises a second threaded connection; wherein the first and second threaded connections are coupled to one another; wherein at least one of the tubular sleeves is positioned in opposing relation to the first threaded connection; and wherein at least one of the tubular sleeves is positioned in opposing relation to the second threaded connection. In an exemplary embodiment, the first tubular member comprises a first threaded connection; wherein the second tubular member comprises a second threaded connection; wherein the first and second threaded connections are coupled to one another; and wherein at least one of the tubular sleeves is not positioned in opposing relation to the first and second threaded connections. In an exemplary embodiment, the carbon content of the tubular member is less than or equal to 0.12 percent; and wherein the carbon equivalent value for the tubular member is less than 0.21. In an exemplary embodiment, the tubular member comprises a wellbore casing.

[00460] An expandable tubular member has been described, wherein the carbon content of the tubular member is greater than 0.12 percent; and wherein the carbon equivalent value for the tubular member is less than 0.36. In an exemplary embodiment, the tubular member comprises a wellbore casing.

[00461] A method of selecting tubular members for radial expansion and plastic deformation has been described that includes: selecting a tubular member from a collection of tubular member; determining a carbon content of the selected tubular member; determining a carbon equivalent value for the selected tubular member; and if the carbon content of the selected tubular member is less than or equal to 0.12 percent and the carbon equivalent value for the selected tubular member is less than 0.21, then determining that the selected tubular member is suitable for radial expansion and plastic deformation.

[00462] A method of selecting tubular members for radial expansion and plastic deformation has been described that includes: selecting a tubular member from a collection of tubular member; determining a carbon content of the selected tubular member; determining a carbon equivalent value for the selected tubular member; and if the carbon content of the selected tubular member is greater than 0.12 percent and the carbon equivalent value for the selected tubular member is less than 0.36, then determining that the selected tubular member is suitable for radial expansion and plastic deformation.

[00463] An expandable tubular member has been described that includes: a tubular body; wherein a yield point of an inner tubular portion of the tubular body is less than a yield point of an outer tubular portion of the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the outer tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the outer tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial

position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body. In an exemplary embodiment, the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body. In an exemplary embodiment, the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body.

[00464] A method of manufacturing an expandable tubular member has been described that includes: providing a tubular member; heat treating the tubular member; and quenching the tubular member; wherein following the quenching, the tubular member comprises a microstructure comprising a hard phase structure and a soft phase structure. In an exemplary embodiment, the provided tubular member comprises, by weight percentage, 0.065% C, 1.44% Mn, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.05% V, 0.01% Mo, 0.01% Nb, and 0.01%Ti. In an exemplary embodiment, the provided tubular member comprises, by weight percentage, 0.18% C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.04% V, 0.01% Mo, 0.03% Nb, and 0.01%Ti. In an exemplary embodiment, the provided tubular member comprises, by weight percentage, 0.08% C, 0.82% Mn, 0.006% P, 0.003% S, 0.30% Si, 0.06% Cu, 0.05% Ni, 0.05% Cr, 0.03% V, 0.03% Mo, 0.01% Nb, and 0.01%Ti. In an exemplary embodiment, the provided tubular member comprises a microstructure comprising one or more of the following: martensite, pearlite, vanadium carbide, nickel carbide, or titanium carbide. In an exemplary embodiment, the provided tubular member comprises a microstructure comprising one or more of the following: pearlite or pearlite striation. In an exemplary embodiment, the provided tubular member comprises a microstructure comprising one or more of the following: grain pearlite, widmanstatten martensite, vanadium carbide, nickel carbide, or titanium carbide. In an exemplary embodiment, the heat treating comprises heating the provided tubular member for about 10 minutes at 790 °C. In an exemplary embodiment, the quenching comprises quenching the heat treated tubular member in water. In an exemplary embodiment, following the quenching, the tubular member comprises a microstructure comprising one or more of the following: ferrite, grain pearlite, or martensite. In an exemplary embodiment, following the quenching, the tubular member comprises a microstructure comprising one or more of the following: ferrite, martensite, or bainite. In an exemplary embodiment, following the quenching, the tubular member comprises a microstructure comprising one or more of the following: bainite, pearlite, or ferrite. In an exemplary embodiment, following the quenching, the tubular member comprises a yield strength of about 67ksi and a tensile strength of about 95 ksi. In an exemplary embodiment, following the quenching, the tubular member comprises a yield strength of about 82 ksi and

a tensile strength of about 130 ksi. In an exemplary embodiment, following the quenching, the tubular member comprises a yield strength of about 60 ksi and a tensile strength of about 97 ksi. In an exemplary embodiment, the method further includes: positioning the quenched tubular member within a preexisting structure; and radially expanding and plastically deforming the tubular member within the preexisting structure.

[00465] A method for manufacturing an expandable tubular member has been described that includes providing a tubular member, heat treating the tubular member, quenching the tubular member, and cold working the tubular member, whereby upon cold working, the yield strength of the material is increased. In an exemplary embodiment, the tubular member is a connection for an expandable tubular member. In an exemplary embodiment, the yield strength increases from approximately 35 ksi to 80 ksi.

[00466] A method for expanding an expandable tubular member has been described that includes providing a tubular member, lubricating the tubular member, and expanding the tubular member. In an exemplary embodiment, the tubular member is a connection for an expandable tubular member.

[00467] A method for formability evaluation has been described that includes providing a tubular member, measuring a plurality of stress and strain property parameters for the tubular member, measuring a Charpy V-notch impact value parameter for the tubular member, measuring a stress rupture parameter for the tubular member, measuring a strain hardening exponent parameter for the tubular member, measuring a plastic strain ratio parameter for the tubular member, comparing the parameters measured for first tubular member to a plurality of parameters measured for a second tubular member, and selecting the first or second tubular member to manufacture an expandable tubular member. In an exemplary embodiment, the stress rupture parameter includes a parameter for burst. In an exemplary embodiment, the stress rupture parameter includes a parameter for collapse. In an exemplary embodiment, a tubular member with a plastic strain ratio parameter of greater than 1.0 will be more resistant to thinning and better suited to tubular expansion.

[00468] An expandable tubular member has been described that includes a tensile strength in the range of 60 ksi to 120 ksi, a yield strength in the range of 40 ksi to 100 ksi, a yield strength to tensile strength ratio in the range of 50% to 85%, a minimum elongation of 35%, a minimum width reduction of 40%, a minimum thickness reduction of 30%, and a minimum anisotropy of 1.5. In an exemplary embodiment, the expandable tubular member further includes a minimum flare expansion of 45%. In an exemplary embodiment, the expandable tubular member further includes a minimum absorbed energy at negative 4 degrees Fahrenheit of 80 ft-lbs in the longitudinal direction, 60 ft-lbs in the transverse direction, and 60 ft lbs in the transverse weld area.

[00469] A method for transforming the yield strength of an expandable tubular member has been described that includes providing a manufactured tubular member, cold rolling the tubular member, inter-critical annealing the tubular member, expanding the tubular member, and heating the tubular member. In an exemplary embodiment, the tubular member comprises a dual steel composition comprising, by weight percentage, 0.12%C, 0.4%Si, 1.5% Mn, and 0.02%Nb.

[00470] An expandable tubular member has been described that includes a tensile strength in the range of 80 ksi to 100 ksi, a yield strength in the range of 60 ksi to 90 ksi, a maximum yield strength to tensile strength ratio of 85%, a minimum elongation of 22%, a minimum width reduction of 30%, a minimum thickness reduction of 35%, and a minimum anisotropy of 0.8. In an exemplary embodiment, the expandable tubular member further includes a minimum flare expansion of 45%. In an exemplary embodiment, the expandable tubular member further includes a minimum absorbed energy at negative 4 degrees Fahrenheit of 80 ft-lbs in a longitudinal direction, 60 ft-lbs in a transverse direction, and 60 ft lbs in a transverse weld area.

[00471] An expandable tubular member has been described that includes a tensile strength in the range of 60 ksi to 120 ksi, a yield strength in the range of 40 ksi to 100 ksi, a yield strength to tensile strength ratio in the range of 50% to 85%, a minimum elongation of 35%, a minimum width reduction of 40%, a minimum thickness reduction of 30%, and a minimum anisotropy of 1.5. In an exemplary embodiment, the expandable tubular member further includes a minimum flare expansion of 75%. In an exemplary embodiment, the expandable tubular member further includes a minimum absorbed energy at negative 4 degrees Fahrenheit of 80 ft-lbs in a longitudinal direction, 60 ft-lbs in a transverse direction, and 60 ft lbs in a transverse weld area.

[00472] A method for transforming the yield strength of an expandable tubular member has been described that includes providing a manufactured tubular member, inter-critical annealing the tubular member, expanding the tubular member, and heating the tubular member.

[00473] An expandable tubular member has been described that includes a yield strength of approximately 76 ksi, a tensile strength of approximately 82 ksi, and an elongation of approximately 32%.

[00474] An expandable tubular member has been described that includes a surface, a self lubricating hard coating on the surface, and a self lubricating soft coating on the surface. In an exemplary embodiment, the self-lubricating soft coating comprises film grease. In an exemplary embodiment, the self lubricating soft coating comprises a lubricated mud. In an exemplary embodiment, the self lubricating soft coating comprises a film grease and a lubricated mud. In an exemplary embodiment, the member comprises a friction coefficient of

not more than 0.05. In an exemplary embodiment, the member comprises a friction coefficient of approximately 0.05. In an exemplary embodiment, the member comprises a friction coefficient of approximately 0.075. In an exemplary embodiment, the member comprises a friction coefficient of approximately 0.1. In an exemplary embodiment, the member comprises a friction coefficient of approximately 0.125.

[00475] An expandable tubular member has been described that includes a yield strength in the range of 40 ksi to 80 ksi, a maximum yield strength to tensile strength ratio of 0.5, a minimum elongation of 30%, a minimum width reduction of 45%, a minimum wall thickness reduction of 30%, and a minimum anisotropy of 1.5.

[00476] An expandable tubular member has been described that includes a friction coefficient of 0.02, whereby the member may be expanded by a force below 100000 lbs. In an exemplary embodiment, the member has approximately a 6 inch diameter.

[00477] An expandable tubular member has been described that includes a lubricant resulting in a friction coefficient of 0.125, a wall thickness of approximately 0.305 inches, and an expansion force of approximately 146000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 25 and a collapse strength of approximately 2400 ksi.

[00478] An expandable tubular member has been described that includes a lubricant resulting in a friction coefficient of 0.075, a wall thickness of approximately 0.350 inches, and an expansion force of approximately 143000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 22 and a collapse strength of approximately 3250 ksi.

[00479] An expandable tubular member has been described that includes a lubricant resulting in a friction coefficient of 0.02, a wall thickness of approximately 0.450 inches, and an expansion force of approximately 150000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 17 and a collapse strength of approximately 5800 ksi.

[00480] An expandable tubular member has been described that includes a lubricant resulting in a friction coefficient of 0.02, a wall thickness of approximately 0.5 inches, and an expansion force of approximately 126000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 15 and a collapse strength of approximately 5350 ksi. In an exemplary embodiment, the member includes a 55 ksi steel.

[00481] An expandable tubular member has been described that includes a lubricant resulting in a friction coefficient of 0.02, a wall thickness of approximately 0.5 inches, and an expansion force of approximately 127000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 15 and a collapse strength of approximately 8400 ksi. In

an exemplary embodiment, the member includes a steel with a 55 ksi yield before expansion and a 100 ksi yield after expansion.

[00482] An expandable tubular member has been described that includes a composition, by weight percentage, of 0.065% C, 1.44% Mn, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.04% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti.

[00483] An expandable tubular member has been described that includes a composition, by weight percentage, of 0.18% C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.03% V, 0.03% Mo, 0.01% Nb, and 0.01% Ti.

[00484] An expandable tubular member has been described that includes a composition, by weight percentage, of 0.08% C, 0.82% Mn, 0.006% P, 0.003% S, 0.3% Si, 0.16% Cu, 0.05% Ni, 0.05% Cr, 0.06% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti.

[00485] An expandable tubular member has been described that includes a composition, by weight percentage, of 0.03% C, 1.48% Mn, 0.014% P, 0.002% S, 0.16% Si, 0.02% Cu, 0.01% Ni, 0.02% Cr, 0.06% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti.

[00486] An expandable tubular member has been described that includes, after a 16% expansion, approximately a 21% change in yield strength, approximately a 24% change in yield ratio, approximately a 18% change in elongation percentage, approximately a 8% change in width reduction percentage, approximately a 15% change in wall thickness reduction percentage, and approximately a 4% change in anisotropy.

[00487] An expandable tubular member has been described that includes, after a 15.6% expansion, approximately a 70% change in yield strength, approximately a 25% change in yield ratio, approximately a 67% change in elongation percentage, approximately a 28% change in width reduction percentage, approximately a 7% change in wall thickness reduction percentage, and approximately a 75% change in anisotropy.

[00488] An expandable tubular member has been described that includes, after a 24% expansion, approximately a 5% change in yield strength, approximately a 11% change in yield ratio, approximately a 20% change in elongation percentage, approximately a 43% change in width reduction percentage, approximately a 2% change in wall thickness reduction percentage, and approximately a 52% change in anisotropy.

[00489] An expandable tubular member has been described that includes, after a 24% expansion, approximately a 10% change in yield strength, approximately a 3% change in yield ratio, approximately a 30% change in elongation percentage, approximately a 13% change in width reduction percentage, approximately a 2% change in wall thickness reduction percentage, and approximately a 17% change in anisotropy.

[00490] An expandable tubular member has been described that includes, after a 24% expansion, approximately a 46% change in yield strength, approximately a 20% change in yield ratio, approximately a 91% change in elongation percentage, approximately a 15%

change in width reduction percentage, approximately a 2% change in wall thickness reduction percentage, and approximately a 18% change in anisotropy.

[00491] An expandable tubular member has been described that includes, after a 16% expansion, approximately a 38% change in yield strength, approximately a 20% change in yield ratio, approximately a 11% change in elongation percentage, approximately a 9% change in width reduction percentage, approximately a 4% change in wall thickness reduction percentage, and approximately a 4% change in anisotropy.

[00492] An expandable tubular member has been described that includes, after a 24% expansion, approximately a 31% change in yield strength, approximately a 14% change in yield ratio, approximately a 48% change in elongation percentage, approximately a 13% change in width reduction percentage, approximately a 2% change in wall thickness reduction percentage, and approximately a 12% change in anisotropy.

[00493] An expandable tubular member has been described that includes, after a 24% expansion, approximately a 38% change in yield strength, approximately a 21% change in yield ratio, approximately a 55% change in elongation percentage, approximately a 16% change in width reduction percentage, approximately a 9% change in wall thickness reduction percentage, and approximately a 13% change in anisotropy.

[00494] An expandable tubular member has been described that includes, after a 16% expansion, approximately a 33% change in yield strength, approximately a 26% change in yield ratio, approximately a 30% change in elongation percentage, approximately a 15% change in width reduction percentage, approximately a 9% change in wall thickness reduction percentage, and approximately a 10% change in anisotropy.

[00495] An expandable tubular member has been described that includes, after a 24% expansion, approximately a 41% change in yield strength, approximately a 27 % change in yield ratio, approximately a 40% change in elongation percentage, approximately a 21% change in width reduction percentage, approximately a 16% change in wall thickness reduction percentage, and approximately a 5% change in anisotropy.

[00496] An expandable tubular member has been described that includes a tensile strength of approximately 80 ksi after 16% expansion, and a tensile strength of approximately 82 ksi after 24% expansion.

[00497] An expandable tubular member has been described that includes a tensile strength of approximately 82 ksi after 16% expansion, and a tensile strength of approximately 88 ksi after 24% expansion.

[00498] An expandable tubular member has been described that includes a tensile strength of approximately 80 ksi before expansion, a tensile strength of approximately 90 ksi after 16% expansion, and a tensile strength of approximately 92 ksi after 24% expansion.

[00499] An expandable tubular member has been described that includes a tensile strength of approximately 115 ksi before expansion, a tensile strength of approximately 120 ksi after 15.2% expansion, and a tensile strength of approximately 121 ksi after 25.2% expansion.

[00500] An expandable tubular member has been described that includes a tensile strength of approximately 100 ksi before expansion, and a tensile strength of approximately 26 ksi after 31.3% expansion.

[00501] An expandable tubular member has been described that includes a tensile strength of approximately 114 ksi before expansion, and a tensile strength of approximately 140 ksi after 15.6% expansion.

[00502] An expandable tubular member has been described that includes, upon quenching in water at approximately 775 °C, a tensile strength of 94 ksi and a yield strength of 56 ksi.

[00503] An expandable tubular member has been described that includes, upon quenching in water at approximately 790 °C, a tensile strength of 94 ksi and a yield strength of 59 ksi.

[00504] An expandable tubular member has been described that includes, upon quenching in water at approximately 735 °C, a tensile strength of 94 ksi and a yield strength of 59 ksi.

[00505] An expandable tubular member has been described that includes, upon quenching in oil at approximately 775 °C, a tensile strength of 84 ksi and a yield strength of 49 ksi.

[00506] An expandable tubular member has been described that includes, upon quenching in oil at approximately 820 °C, a tensile strength of 82 ksi and a yield strength of 61 ksi.

[00507] An expandable tubular member has been described that includes, upon quenching in oil at approximately 750 °C, a tensile strength of 109 ksi and a yield strength of 58 ksi.

[00508] An expandable tubular member has been described that includes, by weight percentage, 0.1% C, 1.5% Mn, and 0.3% Si. In an exemplary embodiment, the member further includes martensite in the range of 15% to 30%.

[00509] An expandable tubular member has been described that includes a yield strength of approximately 80 ksi, a yield strength to tensile strength ratio of approximately 0.86, a longitudinal elongation of approximately 14.8%, a width reduction of approximately 38%, a wall thickness reduction of approximately 43%, and an anisotropy of approximately 0.87.

[00510] An expandable tubular member has been described that includes a yield strength of approximately 81 ksi, a yield strength to tensile strength ratio of approximately 0.83, a longitudinal elongation of approximately 14.9%, a width reduction of approximately 38%, a wall thickness reduction of approximately 43%, and an anisotropy of approximately 0.83.

[00511] An expandable tubular member has been described that includes a yield strength of approximately 79 ksi, a yield strength to tensile strength ratio of approximately 0.82, a longitudinal elongation of approximately 15.9%, a width reduction of approximately 44%, a wall thickness reduction of approximately 43%, and an anisotropy of approximately 1.03.

[00512] An expandable tubular member has been described that includes a yield strength of approximately 80 ksi, a yield strength to tensile strength ratio of approximately 0.83, a longitudinal elongation of approximately 15.3%, a width reduction of approximately 40%, a wall thickness reduction of approximately 43%, and an anisotropy of approximately 0.92.

[00513] An expandable tubular member has been described that includes an elongation of approximately 21%, a width reduction of approximately 35%, a wall thickness reduction of approximately 38%, and an anisotropy of approximately 0.89.

[00514] An expandable tubular member has been described that includes a yield strength of approximately 77 ksi, a yield strength to tensile strength ratio of approximately 0.82, a longitudinal elongation of approximately 16%, a width reduction of approximately 32%, a wall thickness reduction of approximately 45%, and an anisotropy of approximately 0.65.

[00515] An expandable tubular member has been described that includes a yield strength of approximately 78 ksi, a yield strength to tensile strength ratio of approximately 0.8, a longitudinal elongation of approximately 16%, a width reduction of approximately 31%, a wall thickness reduction of approximately 45%, and an anisotropy of approximately 0.63.

[00516] An expandable tubular member has been described that includes, upon quenching and tempering, a yield strength of approximately 84 ksi, a yield strength to tensile strength ratio of approximately 0.84, a longitudinal elongation of approximately 20.5%, a width reduction of approximately 40%, a wall thickness reduction of approximately 42%, and an anisotropy of approximately 0.94.

[00517] An expandable tubular member has been described that includes a yield strength of approximately 80 ksi, a yield strength to tensile strength ratio of approximately 0.72, an elongation of approximately 35%, a width reduction of approximately 35%, a wall thickness reduction of approximately 33%, and an anisotropy of approximately 0.92. In an

exemplary embodiment, the member is processed comprising the steps of hot stretching, reducing at approximately 1950 °C, and rotary straightening.

[00518] An expandable tubular member has been described that includes a yield strength of approximately 90 ksi, a yield strength to tensile strength ratio of approximately 0.88, an elongation of approximately 25%, a width reduction of approximately 22%, a wall thickness reduction of approximately 20%, and an anisotropy of approximately 1.1. In an exemplary embodiment, the member is processed comprising the steps of normalization at approximately 1850 °C, cold drawing, annealing at approximately 1050 °C, and rotary straightening.

[00519] An expandable tubular member has been described that includes a yield strength of approximately 88 ksi, a yield strength to tensile strength ratio of approximately 0.87, an elongation of approximately 16%, a width reduction of approximately 24%, a wall thickness reduction of approximately 30%, and an anisotropy of approximately 0.76. In an exemplary embodiment, the member is processed comprising the steps of hot stretching, reducing at approximately 1950 °C, cold drawing, annealing, and rotary straightening.

[00520] An expandable tubular member has been described that includes a yield strength of approximately 48 ksi, a yield strength to tensile strength ratio of approximately 0.73, an elongation of approximately 38%, a width reduction of approximately 43%, a wall thickness reduction of approximately 49%, and an anisotropy of approximately 0.83. In an exemplary embodiment, the member is processed comprising the steps of hot stretching, reducing at approximately 1850 °C, and rotary straightening.

[00521] An expandable tubular member has been described that includes a yield strength of approximately 46 ksi, a yield strength to tensile strength ratio of approximately 0.69, an elongation of approximately 40%, a width reduction of approximately 50%, a wall thickness reduction of approximately 53%, and an anisotropy of approximately 0.93. In an exemplary embodiment, the member is processed comprising the steps of hot reducing at approximately 1850 °C, cold sizing, and rotary straightening.

[00522] An expandable tubular member has been described that includes a yield strength of approximately 53 ksi, a yield strength to tensile strength ratio of approximately 0.85, an elongation of approximately 49%, a width reduction of approximately 49%, a wall thickness reduction of approximately 46%, and an anisotropy of approximately 1.1. In an exemplary embodiment, the member is processed comprising the steps of hot stretching, reducing at approximately 1850 °C, and rotary straightening.

[00523] An expandable tubular member has been described that includes, upon quenching and tempering, after a flare expansion of 42%, an absorbed energy in the longitudinal direction of 125 ft-lbs, an absorbed energy in the transverse direction of 59 ft-lbs, and an absorbed energy in the weld of 176 ft-lbs.

[00524] An expandable tubular member has been described that includes, upon quenching and tempering, after a flare expansion of 52%, an absorbed energy in the longitudinal direction of 145 ft-lbs, an absorbed energy in the transverse direction of 59 ft-lbs, and an absorbed energy in the weld of 174 ft-lbs.

[00525] It is understood that variations may be made in the foregoing without departing from the scope of the invention. For example, the teachings of the present illustrative embodiments may be used to provide a wellbore casing, a pipeline, or a structural support. Furthermore, the elements and teachings of the various illustrative embodiments may be combined in whole or in part in some or all of the illustrative embodiments. In addition, one or more of the elements and teachings of the various illustrative embodiments may be omitted, at least in part, and/or combined, at least in part, with one or more of the other elements and teachings of the various illustrative embodiments.

[00526] Although illustrative embodiments of the invention have been shown and described, a wide range of modification, changes and substitution is contemplated in the foregoing disclosure. In some instances, some features of the present invention may be employed without a corresponding use of the other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.

What is claimed is:

1. A method of forming a tubular liner within a preexisting structure, comprising:
positioning a tubular assembly within the preexisting structure; and
radially expanding and plastically deforming the tubular assembly within the preexisting structure;
wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly.

2. The method of claim 1, wherein the predetermined portion of the tubular assembly has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

3. The method of claim 1, wherein the predetermined portion of the tubular assembly has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

4. The method of claim 1, wherein the predetermined portion of the tubular assembly has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

5. The method of claim 1, wherein the predetermined portion of the tubular assembly has a larger inside diameter after the radial expansion and plastic deformation than other portions of the tubular assembly.

6. The method of claim 5, further comprising:
positioning another tubular assembly within the preexisting structure in overlapping relation to the tubular assembly; and
radially expanding and plastically deforming the other tubular assembly within the preexisting structure;
wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the other tubular assembly has a lower yield point than another portion of the other tubular assembly.

7. The method of claim 6, wherein the inside diameter of the radially expanded and plastically deformed other portion of the tubular assembly is equal to the inside diameter of

the radially expanded and plastically deformed other portion of the other tubular assembly.

8. The method of claim 1, wherein the predetermined portion of the tubular assembly comprises an end portion of the tubular assembly.

9. The method of claim 1, wherein the predetermined portion of the tubular assembly comprises a plurality of predetermined portions of the tubular assembly.

10. The method of claim 1, wherein the predetermined portion of the tubular assembly comprises a plurality of spaced apart predetermined portions of the tubular assembly.

11. The method of claim 1, wherein the other portion of the tubular assembly comprises an end portion of the tubular assembly.

12. The method of claim 1, wherein the other portion of the tubular assembly comprises a plurality of other portions of the tubular assembly.

13. The method of claim 1, wherein the other portion of the tubular assembly comprises a plurality of spaced apart other portions of the tubular assembly.

14. The method of claim 1, wherein the tubular assembly comprises a plurality of tubular members coupled to one another by corresponding tubular couplings.

15. The method of claim 14, wherein the tubular couplings comprise the predetermined portions of the tubular assembly; and wherein the tubular members comprise the other portion of the tubular assembly.

16. The method of claim 14, wherein one or more of the tubular couplings comprise the predetermined portions of the tubular assembly.

17. The method of claim 14, wherein one or more of the tubular members comprise the predetermined portions of the tubular assembly.

18. The method of claim 1, wherein the predetermined portion of the tubular assembly defines one or more openings.

19. The method of claim 18, wherein one or more of the openings comprise slots.

20. The method of claim 18, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1.

21. The method of claim 1, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1.

22. The method of claim 1, wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12.

23. The method of claim 1, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12.

24. The method of claim 1, wherein the predetermined portion of the tubular assembly comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr.

25. The method of claim 24, wherein the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation.

26. The method of claim 24, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

27. The method of claim 24, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.48.

28. The method of claim 1, wherein the predetermined portion of the tubular assembly comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr.

29. The method of claim 28, wherein the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic

deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation.

30. The method of claim 28, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

31. The method of claim 28, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.04.

32. The method of claim 1, wherein the predetermined portion of the tubular assembly comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr.

33. The method of claim 32, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.92.

34. The method of claim 1, wherein the predetermined portion of the tubular assembly comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr.

35. The method of claim 34, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.34.

36. The method of claim 1, wherein the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation.

37. The method of claim 1, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

38. The method of claim 1, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about

1.48.

39. The method of claim 1, wherein the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation.

40. The method of claim 1, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

41. The method of claim 1, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.04.

42. The method of claim 1, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.92.

43. The method of claim 1, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.34.

44. The method of claim 1, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92.

45. The method of claim 1, wherein the yield point of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi.

46. The method of claim 1, wherein the expandability coefficient of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is greater than 0.12.

47. The method of claim 1, wherein the expandability coefficient of the predetermined

portion of the tubular assembly is greater than the expandability coefficient of the other portion of the tubular assembly.

48. The method of claim 1, wherein the tubular assembly comprises a wellbore casing.

49. The method of claim 1, wherein the tubular assembly comprises a pipeline.

50. The method of claim 1, wherein the tubular assembly comprises a structural support.

51. An expandable tubular member comprising a steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr.

52. The tubular member of claim 51, wherein a yield point of the tubular member is at most about 46.9 ksi prior to a radial expansion and plastic deformation; and wherein a yield point of the tubular member is at least about 65.9 ksi after the radial expansion and plastic deformation.

53. The tubular member of claim 51, wherein the yield point of the tubular member after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the tubular member prior to the radial expansion and plastic deformation.

54. The tubular member of claim 51, wherein the anisotropy of the tubular member, prior to a radial expansion and plastic deformation, is about 1.48.

55. The tubular member of claim 51, wherein the tubular member comprises a wellbore casing.

56. The tubular member of claim 51, wherein the tubular member comprises a pipeline.

57. The tubular member of claim 51, wherein the tubular member comprises a structural support.

58. An expandable tubular member comprising a steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr.

59. The tubular member of claim 58, wherein a yield point of the tubular member is at most about 57.8 ksi prior to a radial expansion and plastic deformation; and wherein the

yield point of the tubular member is at least about 74.4 ksi after the radial expansion and plastic deformation.

60. The tubular member of claim 58, wherein a yield point of the of the tubular member after a radial expansion and plastic deformation is at least about 28 % greater than the yield point of the tubular member prior to the radial expansion and plastic deformation.

61. The tubular member of claim 58, wherein the anisotropy of the tubular member, prior to a radial expansion and plastic deformation, is about 1.04.

62. The tubular member of claim 58, wherein the tubular member comprises a wellbore casing.

63. The tubular member of claim 58, wherein the tubular member comprises a pipeline.

64. The tubular member of claim 58, wherein the tubular member comprises a structural support.

65. An expandable tubular member comprising a steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr.

66. The tubular member of claim 65, wherein the anisotropy of the tubular member, prior to a radial expansion and plastic deformation, is about 1.92.

67. The tubular member of claim 65, wherein the tubular member comprises a wellbore casing.

68. The tubular member of claim 65, wherein the tubular member comprises a pipeline.

69. The tubular member of claim 65, wherein the tubular member comprises a structural support.

70. An expandable tubular member comprising a steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr.

71. The tubular member of claim 70, wherein the anisotropy of the tubular member, prior to a radial expansion and plastic deformation, is about 1.34.

72. The tubular member of claim 70, wherein the tubular member comprises a wellbore casing.

73. The tubular member of claim 70, wherein the tubular member comprises a pipeline.

74. The tubular member of claim 70, wherein the tubular member comprises a structural support.

75. An expandable tubular member, wherein the yield point of the expandable tubular member is at most about 46.9 ksi prior to a radial expansion and plastic deformation; and wherein the yield point of the expandable tubular member is at least about 65.9 ksi after the radial expansion and plastic deformation.

76. The tubular member of claim 75, wherein the tubular member comprises a wellbore casing.

77. The tubular member of claim 75, wherein the tubular member comprises a pipeline.

78. The tubular member of claim 75, wherein the tubular member comprises a structural support.

79. An expandable tubular member, wherein a yield point of the expandable tubular member after a radial expansion and plastic deformation is at least about 40 % greater than the yield point of the expandable tubular member prior to the radial expansion and plastic deformation.

80. The tubular member of claim 79, wherein the tubular member comprises a wellbore casing.

81. The tubular member of claim 79, wherein the tubular member comprises a pipeline.

82. The tubular member of claim 79, wherein the tubular member comprises a structural support.

83. An expandable tubular member, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.48.

84. The tubular member of claim 83, wherein the tubular member comprises a wellbore casing.

85. The tubular member of claim 83, wherein the tubular member comprises a pipeline.

86. The tubular member of claim 83, wherein the tubular member comprises a structural support.

87. An expandable tubular member, wherein the yield point of the expandable tubular member is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the expandable tubular member is at least about 74.4 ksi after the radial expansion and plastic deformation.

88. The tubular member of claim 87, wherein the tubular member comprises a wellbore casing.

89. The tubular member of claim 87, wherein the tubular member comprises a pipeline.

90. The tubular member of claim 87, wherein the tubular member comprises a structural support.

91. An expandable tubular member, wherein the yield point of the expandable tubular member after a radial expansion and plastic deformation is at least about 28 % greater than the yield point of the expandable tubular member prior to the radial expansion and plastic deformation.

92. The tubular member of claim 91, wherein the tubular member comprises a wellbore casing.

93. The tubular member of claim 91, wherein the tubular member comprises a pipeline.

94. The tubular member of claim 91, wherein the tubular member comprises a structural support.

95. An expandable tubular member, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.04.

96. The tubular member of claim 95, wherein the tubular member comprises a wellbore casing.

97. The tubular member of claim 95, wherein the tubular member comprises a pipeline.

98. The tubular member of claim 95, wherein the tubular member comprises a structural support.

99. An expandable tubular member, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.92.

100. The tubular member of claim 99, wherein the tubular member comprises a wellbore casing.

101. The tubular member of claim 99, wherein the tubular member comprises a pipeline.

102. The tubular member of claim 99, wherein the tubular member comprises a structural support.

103. An expandable tubular member, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, is at least about 1.34.

104. The tubular member of claim 103, wherein the tubular member comprises a wellbore casing.

105. The tubular member of claim 103, wherein the tubular member comprises a pipeline.

106. The tubular member of claim 103, wherein the tubular member comprises a structural support.

107. An expandable tubular member, wherein the anisotropy of the expandable tubular member, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92.

108. The tubular member of claim 107, wherein the tubular member comprises a wellbore casing.

109. The tubular member of claim 107, wherein the tubular member comprises a pipeline.

110. The tubular member of claim 107, wherein the tubular member comprises a structural support.

111. An expandable tubular member, wherein the yield point of the expandable tubular member, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi.

112. The tubular member of claim 111, wherein the tubular member comprises a wellbore casing.

113. The tubular member of claim 111, wherein the tubular member comprises a pipeline.

114. The tubular member of claim 111, wherein the tubular member comprises a structural support.

115. An expandable tubular member, wherein the expandability coefficient of the expandable tubular member, prior to the radial expansion and plastic deformation, is greater than 0.12.

116. The tubular member of claim 115, wherein the tubular member comprises a wellbore casing.

117. The tubular member of claim 115, wherein the tubular member comprises a pipeline.

118. The tubular member of claim 115, wherein the tubular member comprises a structural support.

119. An expandable tubular member, wherein the expandability coefficient of the expandable tubular member is greater than the expandability coefficient of another portion of the expandable tubular member.

120. The tubular member of claim 119, wherein the tubular member comprises a wellbore casing.

121. The tubular member of claim 119, wherein the tubular member comprises a pipeline.

122. The tubular member of claim 119, wherein the tubular member comprises a structural support.

123. An expandable tubular member, wherein the tubular member has a higher ductility and a lower yield point prior to a radial expansion and plastic deformation than after the radial expansion and plastic deformation.

124. The tubular member of claim 123, wherein the tubular member comprises a wellbore casing.

125. The tubular member of claim 123, wherein the tubular member comprises a pipeline.

126. The tubular member of claim 123, wherein the tubular member comprises a structural support.

127. A method of radially expanding and plastically deforming a tubular assembly comprising a first tubular member coupled to a second tubular member, comprising:

radially expanding and plastically deforming the tubular assembly within a preexisting structure; and

using less power to radially expand each unit length of the first tubular member than to radially expand each unit length of the second tubular member.

128. The method of claim 127, wherein the tubular member comprises a wellbore casing.

129. The method of claim 127, wherein the tubular member comprises a pipeline.

130. The method of claim 127, wherein the tubular member comprises a structural support.

131. A system for radially expanding and plastically deforming a tubular assembly comprising a first tubular member coupled to a second tubular member, comprising:

means for radially expanding the tubular assembly within a preexisting structure; and

means for using less power to radially expand each unit length of the first tubular member than to radially expand each unit length of the second tubular member.

132. The system of claim 131, wherein the tubular member comprises a wellbore casing.

133. The system of claim 131, wherein the tubular member comprises a pipeline.

134. The system of claim 131, wherein the tubular member comprises a structural support.

135. A method of manufacturing a tubular member, comprising:
processing a tubular member until the tubular member is characterized by one or more intermediate characteristics;
positioning the tubular member within a preexisting structure; and
processing the tubular member within the preexisting structure until the tubular member is characterized one or more final characteristics.

136. The method of claim 135, wherein the tubular member comprises a wellbore casing.

137. The method of claim 135, wherein the tubular member comprises a pipeline.

138. The method of claim 135, wherein the tubular member comprises a structural support.

139. The method of claim 135, wherein the preexisting structure comprises a wellbore that traverses a subterranean formation.

140. The method of claim 135, wherein the characteristics are selected from a group consisting of yield point and ductility.

141. The method of claim 135, wherein processing the tubular member within the preexisting structure until the tubular member is characterized one or more final characteristics comprises:
radially expanding and plastically deforming the tubular member within the preexisting structure.

142. An apparatus, comprising:
an expandable tubular assembly; and
an expansion device coupled to the expandable tubular assembly;

wherein a predetermined portion of the expandable tubular assembly has a lower yield point than another portion of the expandable tubular assembly.

143. The apparatus of claim 142, wherein the expansion device comprises a rotary expansion device.

144. The apparatus of claim 142, wherein the expansion device comprises an axially displaceable expansion device.

145. The apparatus of claim 142, wherein the expansion device comprises a reciprocating expansion device.

146. The apparatus of claim 142, wherein the expansion device comprises a hydroforming expansion device.

147. The apparatus of claim 142, wherein the expansion device comprises an impulsive force expansion device.

148. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly has a higher ductility and a lower yield point than another portion of the expandable tubular assembly.

149. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly has a higher ductility than another portion of the expandable tubular assembly.

150. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly has a lower yield point than another portion of the expandable tubular assembly.

151. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly comprises an end portion of the tubular assembly.

152. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly comprises a plurality of predetermined portions of the tubular assembly.

153. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly comprises a plurality of spaced apart predetermined portions of the tubular assembly.

154. The apparatus of claim 142, wherein the other portion of the tubular assembly comprises an end portion of the tubular assembly.

155. The apparatus of claim 142, wherein the other portion of the tubular assembly comprises a plurality of other portions of the tubular assembly.

156. The apparatus of claim 142, wherein the other portion of the tubular assembly comprises a plurality of spaced apart other portions of the tubular assembly.

157. The apparatus of claim 142, wherein the tubular assembly comprises a plurality of tubular members coupled to one another by corresponding tubular couplings.

158. The apparatus of claim 157, wherein the tubular couplings comprise the predetermined portions of the tubular assembly; and wherein the tubular members comprise the other portion of the tubular assembly.

159. The apparatus of claim 157, wherein one or more of the tubular couplings comprise the predetermined portions of the tubular assembly.

160. The apparatus of claim 157, wherein one or more of the tubular members comprise the predetermined portions of the tubular assembly.

161. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly defines one or more openings.

162. The apparatus of claim 161, wherein one or more of the openings comprise slots.

163. The apparatus of claim 161, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1.

164. The apparatus of claim 142, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1.

165. The apparatus of claim 142, wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12.

166. The apparatus of claim 142, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12.

167. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni; and 0.02 % Cr.

168. The apparatus of claim 167, wherein the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi.

169. The apparatus of claim 167, wherein the anisotropy of the predetermined portion of the tubular assembly is about 1.48.

170. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr.

171. The apparatus of claim 170, wherein the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi.

172. The apparatus of claim 170, wherein the anisotropy of the predetermined portion of the tubular assembly is about 1.04.

173. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr.

174. The apparatus of claim 173, wherein the anisotropy of the predetermined portion of the tubular assembly is about 1.92.

175. The apparatus of claim 142, wherein the predetermined portion of the tubular assembly comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr.

176. The apparatus of claim 175, wherein the anisotropy of the predetermined portion of the tubular assembly is at least about 1.34.

177. The apparatus of claim 142, wherein the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi.

178. The apparatus of claim 142, wherein the anisotropy of the predetermined portion of the tubular assembly is at least about 1.48.

179. The apparatus of claim 142, wherein the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi.

180. The apparatus of claim 142, wherein the anisotropy of the predetermined portion of the tubular assembly is at least about 1.04.

181. The apparatus of claim 142, wherein the anisotropy of the predetermined portion of the tubular assembly is at least about 1.92.

182. The apparatus of claim 142, wherein the anisotropy of the predetermined portion of the tubular assembly is at least about 1.34.

183. The apparatus of claim 142, wherein the anisotropy of the predetermined portion of the tubular assembly ranges from about 1.04 to about 1.92.

184. The apparatus of claim 142, wherein the yield point of the predetermined portion of the tubular assembly ranges from about 47.6 ksi to about 61.7 ksi.

185. The apparatus of claim 142, wherein the expandability coefficient of the predetermined portion of the tubular assembly is greater than 0.12.

186. The apparatus of claim 142, wherein the expandability coefficient of the predetermined portion of the tubular assembly is greater than the expandability coefficient of the other portion of the tubular assembly.

187. The apparatus of claim 142, wherein the tubular assembly comprises a wellbore casing.

188. The apparatus of claim 142, wherein the tubular assembly comprises a pipeline.

189. The apparatus of claim 142, wherein the tubular assembly comprises a structural support.

190. An expandable tubular member, wherein a yield point of the expandable tubular member after a radial expansion and plastic deformation is at least about 5.8 % greater than the yield point of the expandable tubular member prior to the radial expansion and plastic deformation.

191. The tubular member of claim 190, wherein the tubular member comprises a wellbore casing.

192. The tubular member of claim 190, wherein the tubular member comprises a pipeline.

193. The tubular member of claim 190, wherein the tubular member comprises a structural support.

194. A method of determining the expandability of a selected tubular member, comprising:
determining an anisotropy value for the selected tubular member;
determining a strain hardening value for the selected tubular member; and
multiplying the anisotropy value times the strain hardening value to generate an expandability value for the selected tubular member.

195. The method of claim 194, wherein an anisotropy value greater than 0.12 indicates that the tubular member is suitable for radial expansion and plastic deformation.

196. The method of claim 194, wherein the tubular member comprises a wellbore casing.

197. The method of claim 194, wherein the tubular member comprises a pipeline.

198. The method of claim 194, wherein the tubular member comprises a structural support.

199. A method of radially expanding and plastically deforming tubular members, comprising:
selecting a tubular member;
determining an anisotropy value for the selected tubular member;
determining a strain hardening value for the selected tubular member;

multiplying the anisotropy value times the strain hardening value to generate an expandability value for the selected tubular member; and

if the anisotropy value is greater than 0.12, then radially expanding and plastically deforming the selected tubular member.

200. The method of claim 199, wherein the tubular member comprises a wellbore casing.

201. The method of claim 199, wherein the tubular member comprises a pipeline.

202. The method of claim 199, wherein the tubular member comprises a structural support.

203. The method of claim 199, wherein radially expanding and plastically deforming the selected tubular member comprises:

inserting the selected tubular member into a preexisting structure; and

then radially expanding and plastically deforming the selected tubular member.

204. The method of claim 203, wherein the preexisting structure comprises a wellbore that traverses a subterranean formation.

205. A radially expandable tubular member apparatus comprising:

a first tubular member;

a second tubular member engaged with the first tubular member forming a joint; and

a sleeve overlapping and coupling the first and second tubular members at the joint;

wherein, prior to a radial expansion and plastic deformation of the apparatus, a predetermined portion of the apparatus has a lower yield point than another portion of the apparatus.

206. The apparatus of claim 205, wherein the predetermined portion of the apparatus has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

207. The apparatus of claim 205, wherein the predetermined portion of the apparatus has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

208. The apparatus of claim 205, wherein the predetermined portion of the apparatus has

a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

209. The apparatus of claim 205, wherein the predetermined portion of the apparatus has a larger inside diameter after the radial expansion and plastic deformation than other portions of the tubular assembly.

210. The apparatus of claim 209, further comprising:

positioning another apparatus within the preexisting structure in overlapping relation to the apparatus; and

radially expanding and plastically deforming the other apparatus within the preexisting structure;

wherein, prior to the radial expansion and plastic deformation of the apparatus, a predetermined portion of the other apparatus has a lower yield point than another portion of the other apparatus.

211. The apparatus of claim 210, wherein the inside diameter of the radially expanded and plastically deformed other portion of the apparatus is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other apparatus.

212. The apparatus of claim 205, wherein the predetermined portion of the apparatus comprises an end portion of the apparatus.

213. The apparatus of claim 205, wherein the predetermined portion of the apparatus comprises a plurality of predetermined portions of the apparatus.

214. The apparatus of claim 205, wherein the predetermined portion of the apparatus comprises a plurality of spaced apart predetermined portions of the apparatus.

215. The apparatus of claim 205, wherein the other portion of the apparatus comprises an end portion of the apparatus.

216. The apparatus of claim 205, wherein the other portion of the apparatus comprises a plurality of other portions of the apparatus.

217. The apparatus of claim 205, wherein the other portion of the apparatus comprises a plurality of spaced apart other portions of the apparatus.

218. The apparatus of claim 205, wherein the apparatus comprises a plurality of tubular members coupled to one another by corresponding tubular couplings.

219. The apparatus of claim 218, wherein the tubular couplings comprise the predetermined portions of the apparatus; and wherein the tubular members comprise the other portion of the apparatus.

220. The apparatus of claim 218, wherein one or more of the tubular couplings comprise the predetermined portions of the apparatus.

221. The apparatus of claim 218, wherein one or more of the tubular members comprise the predetermined portions of the apparatus.

222. The apparatus of claim 205, wherein the predetermined portion of the apparatus defines one or more openings.

223. The apparatus of claim 222, wherein one or more of the openings comprise slots.

224. The apparatus of claim 222, wherein the anisotropy for the predetermined portion of the apparatus is greater than 1.

225. The apparatus of claim 205, wherein the anisotropy for the predetermined portion of the apparatus is greater than 1.

226. The apparatus of claim 205, wherein the strain hardening exponent for the predetermined portion of the apparatus is greater than 0.12.

227. The apparatus of claim 205, wherein the anisotropy for the predetermined portion of the apparatus is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the apparatus is greater than 0.12.

228. The apparatus of claim 205, wherein the predetermined portion of the apparatus comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr.

229. The apparatus of claim 228, wherein the yield point of the predetermined portion of

the apparatus is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 65.9 ksi after the radial expansion and plastic deformation.

230. The apparatus of claim 228, wherein the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation.

231. The apparatus of claim 228, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.48.

232. The apparatus of claim 205, wherein the predetermined portion of the apparatus comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr.

233. The apparatus of claim 232, wherein the yield point of the predetermined portion of the apparatus is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 74.4 ksi after the radial expansion and plastic deformation.

234. The apparatus of claim 232, wherein the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation.

235. The apparatus of claim 232, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.04.

236. The apparatus of claim 205, wherein the predetermined portion of the apparatus comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr.

237. The apparatus of claim 236, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.92.

238. The apparatus of claim 205, wherein the predetermined portion of the apparatus

comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr.

239. The apparatus of claim 238, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.34.

240. The apparatus of claim 205, wherein the yield point of the predetermined portion of the apparatus is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 65.9 ksi after the radial expansion and plastic deformation.

241. The apparatus of claim 205, wherein the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation.

242. The apparatus of claim 205, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.48.

243. The apparatus of claim 205, wherein the yield point of the predetermined portion of the apparatus is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 74.4 ksi after the radial expansion and plastic deformation.

244. The apparatus of claim 205, wherein the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation.

245. The apparatus of claim 205, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.04.

246. The apparatus of claim 205, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.92.

247. The apparatus of claim 205, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.34.

248. The apparatus of claim 205, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92.

249. The apparatus of claim 205, wherein the yield point of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi.

250. The apparatus of claim 205, wherein the expandability coefficient of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is greater than 0.12.

251. The apparatus of claim 205, wherein the expandability coefficient of the predetermined portion of the apparatus is greater than the expandability coefficient of the other portion of the apparatus.

252. The apparatus of claim 205, wherein the apparatus comprises a wellbore casing.

253. The apparatus of claim 205, wherein the apparatus comprises a pipeline.

254. The apparatus of claim 205, wherein the apparatus comprises a structural support.

255. A radially expandable tubular member apparatus comprising:
a first tubular member;
a second tubular member engaged with the first tubular member forming a joint;
a sleeve overlapping and coupling the first and second tubular members at the joint;
the sleeve having opposite tapered ends and a flange engaged in a recess formed in an adjacent tubular member; and
one of the tapered ends being a surface formed on the flange;
wherein, prior to a radial expansion and plastic deformation of the apparatus, a predetermined portion of the apparatus has a lower yield point than another portion of the apparatus.

256. The apparatus as defined in claim 255 wherein the recess includes a tapered wall in mating engagement with the tapered end formed on the flange.

257. The apparatus as defined in claim 255 wherein the sleeve includes a flange at each tapered end and each tapered end is formed on a respective flange.

258. The apparatus as defined in claim 257 wherein each tubular member includes a recess.

259. The apparatus as defined in claim 258 wherein each flange is engaged in a respective one of the recesses.

260. The apparatus as defined in claim 259 wherein each recess includes a tapered wall in mating engagement with the tapered end formed on a respective one of the flanges.

261. The apparatus of claim 255, wherein the predetermined portion of the apparatus has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

262. The apparatus of claim 255, wherein the predetermined portion of the apparatus has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

263. The apparatus of claim 255, wherein the predetermined portion of the apparatus has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

264. The apparatus of claim 255, wherein the predetermined portion of the apparatus has a larger inside diameter after the radial expansion and plastic deformation than other portions of the tubular assembly.

265. The apparatus of claim 264, further comprising:
positioning another apparatus within the preexisting structure in overlapping relation to the apparatus; and
radially expanding and plastically deforming the other apparatus within the preexisting structure;
wherein, prior to the radial expansion and plastic deformation of the apparatus, a predetermined portion of the other apparatus has a lower yield point than another portion of the other apparatus.

266. The apparatus of claim 265, wherein the inside diameter of the radially expanded and plastically deformed other portion of the apparatus is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other apparatus.

267. The apparatus of claim 255, wherein the predetermined portion of the apparatus comprises an end portion of the apparatus.

268. The apparatus of claim 255, wherein the predetermined portion of the apparatus comprises a plurality of predetermined portions of the apparatus.

269. The apparatus of claim 255, wherein the predetermined portion of the apparatus comprises a plurality of spaced apart predetermined portions of the apparatus.

270. The apparatus of claim 255, wherein the other portion of the apparatus comprises an end portion of the apparatus.

271. The apparatus of claim 255, wherein the other portion of the apparatus comprises a plurality of other portions of the apparatus.

272. The apparatus of claim 255, wherein the other portion of the apparatus comprises a plurality of spaced apart other portions of the apparatus.

273. The apparatus of claim 255, wherein the apparatus comprises a plurality of tubular members coupled to one another by corresponding tubular couplings.

274. The apparatus of claim 273, wherein the tubular couplings comprise the predetermined portions of the apparatus; and wherein the tubular members comprise the other portion of the apparatus.

275. The apparatus of claim 273, wherein one or more of the tubular couplings comprise the predetermined portions of the apparatus.

276. The apparatus of claim 273, wherein one or more of the tubular members comprise the predetermined portions of the apparatus.

277. The apparatus of claim 255, wherein the predetermined portion of the apparatus

defines one or more openings.

278. The apparatus of claim 277, wherein one or more of the openings comprise slots.

279. The apparatus of claim 277, wherein the anisotropy for the predetermined portion of the apparatus is greater than 1.

280. The apparatus of claim 255, wherein the anisotropy for the predetermined portion of the apparatus is greater than 1.

281. The apparatus of claim 255, wherein the strain hardening exponent for the predetermined portion of the apparatus is greater than 0.12.

282. The apparatus of claim 255, wherein the anisotropy for the predetermined portion of the apparatus is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the apparatus is greater than 0.12.

283. The apparatus of claim 255, wherein the predetermined portion of the apparatus comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr.

284. The apparatus of claim 283, wherein the yield point of the predetermined portion of the apparatus is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 65.9 ksi after the radial expansion and plastic deformation.

285. The apparatus of claim 283, wherein the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation.

286. The apparatus of claim 283, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.48.

287. The apparatus of claim 255, wherein the predetermined portion of the apparatus comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr.

288. The apparatus of claim 287, wherein the yield point of the predetermined portion of the apparatus is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 74.4 ksi after the radial expansion and plastic deformation.

289. The apparatus of claim 287, wherein the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation.

290. The apparatus of claim 287, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.04.

291. The apparatus of claim 255, wherein the predetermined portion of the apparatus comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr.

292. The apparatus of claim 291, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.92.

293. The apparatus of claim 255, wherein the predetermined portion of the apparatus comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr.

294. The apparatus of claim 293, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is about 1.34.

295. The apparatus of claim 255, wherein the yield point of the predetermined portion of the apparatus is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 65.9 ksi after the radial expansion and plastic deformation.

296. The apparatus of claim 255, wherein the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation.

297. The apparatus of claim 255, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.48.

298. The apparatus of claim 255, wherein the yield point of the predetermined portion of the apparatus is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the apparatus is at least about 74.4 ksi after the radial expansion and plastic deformation.

299. The apparatus of claim 255, wherein the yield point of the predetermined portion of the apparatus after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the apparatus prior to the radial expansion and plastic deformation.

300. The apparatus of claim 255, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.04.

301. The apparatus of claim 255, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.92.

302. The apparatus of claim 255, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is at least about 1.34.

303. The apparatus of claim 255, wherein the anisotropy of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92.

304. The apparatus of claim 255, wherein the yield point of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi.

305. The apparatus of claim 255, wherein the expandability coefficient of the predetermined portion of the apparatus, prior to the radial expansion and plastic deformation, is greater than 0.12.

306. The apparatus of claim 255, wherein the expandability coefficient of the predetermined portion of the apparatus is greater than the expandability coefficient of the

other portion of the apparatus.

307. The apparatus of claim 255, wherein the apparatus comprises a wellbore casing.

308. The apparatus of claim 255, wherein the apparatus comprises a pipeline.

309. The apparatus of claim 255, wherein the apparatus comprises a structural support.

310. A method of joining radially expandable tubular members comprising:
providing a first tubular member;
engaging a second tubular member with the first tubular member to form a joint;
providing a sleeve;
mounting the sleeve for overlapping and coupling the first and second tubular members at the joint;
wherein the first tubular member, the second tubular member, and the sleeve define a tubular assembly; and
radially expanding and plastically deforming the tubular assembly;
wherein, prior to the radial expansion and plastic deformation, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly.

311. The method of claim 310, wherein the predetermined portion of the tubular assembly has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

312. The method of claim 310, wherein the predetermined portion of the tubular assembly has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

313. The method of claim 310, wherein the predetermined portion of the tubular assembly has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

314. The method of claim 310, wherein the predetermined portion of the tubular assembly has a larger inside diameter after the radial expansion and plastic deformation than the other portion of the tubular assembly.

315. The method of claim 314, further comprising:

positioning another tubular assembly within the preexisting structure in overlapping relation to the tubular assembly; and

radially expanding and plastically deforming the other tubular assembly within the preexisting structure;

wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the other tubular assembly has a lower yield point than another portion of the other tubular assembly.

316. The method of claim 315, wherein the inside diameter of the radially expanded and plastically deformed other portion of the tubular assembly is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other tubular assembly.

317. The method of claim 310, wherein the predetermined portion of the tubular assembly comprises an end portion of the tubular assembly.

318. The method of claim 310, wherein the predetermined portion of the tubular assembly comprises a plurality of predetermined portions of the tubular assembly.

319. The method of claim 310, wherein the predetermined portion of the tubular assembly comprises a plurality of spaced apart predetermined portions of the tubular assembly.

320. The method of claim 310, wherein the other portion of the tubular assembly comprises an end portion of the tubular assembly.

321. The method of claim 310, wherein the other portion of the tubular assembly comprises a plurality of other portions of the tubular assembly.

322. The method of claim 310, wherein the other portion of the tubular assembly comprises a plurality of spaced apart other portions of the tubular assembly.

323. The method of claim 310, wherein the tubular assembly comprises a plurality of tubular members coupled to one another by corresponding tubular couplings.

324. The method of claim 323, wherein the tubular couplings comprise the predetermined portions of the tubular assembly; and wherein the tubular members comprise the other portion of the tubular assembly.

325. The method of claim 323, wherein one or more of the tubular couplings comprise the predetermined portions of the tubular assembly.

326. The method of claim 323, wherein one or more of the tubular members comprise the predetermined portions of the tubular assembly.

327. The method of claim 310, wherein the predetermined portion of the tubular assembly defines one or more openings.

328. The method of claim 327, wherein one or more of the openings comprise slots.

329. The method of claim 327, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1.

330. The method of claim 310, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1.

331. The method of claim 310, wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12.

332. The method of claim 310, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12.

333. The method of claim 310, wherein the predetermined portion of the tubular assembly comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr.

334. The method of claim 333, wherein the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation.

335. The method of claim 333, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the

radial expansion and plastic deformation.

336. The method of claim 333, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.48.

337. The method of claim 310, wherein the predetermined portion of the tubular assembly comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr.

338. The method of claim 337, wherein the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation.

339. The method of claim 337, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

340. The method of claim 337, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.04.

341. The method of claim 310, wherein the predetermined portion of the tubular assembly comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr.

342. The method of claim 341, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.92.

343. The method of claim 310, wherein the predetermined portion of the tubular assembly comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr.

344. The method of claim 343, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.34.

345. The method of claim 310, wherein the yield point of the predetermined portion of the

tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation.

346. The method of claim 310, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

347. The method of claim 310, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.48.

348. The method of claim 310, wherein the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation.

349. The method of claim 310, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

350. The method of claim 310, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.04.

351. The method of claim 310, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.92.

352. The method of claim 310, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.34.

353. The method of claim 310, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about

1.04 to about 1.92.

354. The method of claim 310, wherein the yield point of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi.

355. The method of claim 310, wherein the expandability coefficient of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is greater than 0.12.

356. The method of claim 310, wherein the expandability coefficient of the predetermined portion of the tubular assembly is greater than the expandability coefficient of the other portion of the tubular assembly.

357. The method of claim 310, wherein the tubular assembly comprises a wellbore casing.

358. The method of claim 310, wherein the tubular assembly comprises a pipeline.

359. The method of claim 310, wherein the tubular assembly comprises a structural support.

360. A method of joining radially expandable tubular members comprising:
providing a first tubular member;
engaging a second tubular member with the first tubular member to form a joint;
providing a sleeve having opposite tapered ends and a flange, one of the tapered ends being a surface formed on the flange;
mounting the sleeve for overlapping and coupling the first and second tubular members at the joint, wherein the flange is engaged in a recess formed in an adjacent one of the tubular members;
wherein the first tubular member, the second tubular member, and the sleeve define a tubular assembly; and
radially expanding and plastically deforming the tubular assembly;
wherein, prior to the radial expansion and plastic deformation, a predetermined portion of the tubular assembly has a lower yield point than another portion of the tubular assembly.

361. The method as defined in claim 360 further comprising:

providing a tapered wall in the recess for mating engagement with the tapered end formed on the flange.

362. The method as defined in claim 360 further comprising:
providing a flange at each tapered end wherein each tapered end is formed on a respective flange.

363. The method as defined in claim 362 further comprising:
providing a recess in each tubular member.

364. The method as defined in claim 363 further comprising:
engaging each flange in a respective one of the recesses.

365. The method as defined in claim 364 further comprising:
providing a tapered wall in each recess for mating engagement with the tapered end formed on a respective one of the flanges.

366. The method of claim 360, wherein the predetermined portion of the tubular assembly has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

367. The method of claim 360, wherein the predetermined portion of the tubular assembly has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

368. The method of claim 360, wherein the predetermined portion of the tubular assembly has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

369. The method of claim 360, wherein the predetermined portion of the tubular assembly has a larger inside diameter after the radial expansion and plastic deformation than the other portion of the tubular assembly.

370. The method of claim 369, further comprising:
positioning another tubular assembly within the preexisting structure in overlapping relation to the tubular assembly; and
radially expanding and plastically deforming the other tubular assembly within the

preexisting structure;

wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the other tubular assembly has a lower yield point than another portion of the other tubular assembly.

371. The method of claim 370, wherein the inside diameter of the radially expanded and plastically deformed other portion of the tubular assembly is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other tubular assembly.

372. The method of claim 360, wherein the predetermined portion of the tubular assembly comprises an end portion of the tubular assembly.

373. The method of claim 360, wherein the predetermined portion of the tubular assembly comprises a plurality of predetermined portions of the tubular assembly.

374. The method of claim 360, wherein the predetermined portion of the tubular assembly comprises a plurality of spaced apart predetermined portions of the tubular assembly.

375. The method of claim 360, wherein the other portion of the tubular assembly comprises an end portion of the tubular assembly.

376. The method of claim 360, wherein the other portion of the tubular assembly comprises a plurality of other portions of the tubular assembly.

377. The method of claim 360, wherein the other portion of the tubular assembly comprises a plurality of spaced apart other portions of the tubular assembly.

378. The method of claim 360, wherein the tubular assembly comprises a plurality of tubular members coupled to one another by corresponding tubular couplings.

379. The method of claim 378, wherein the tubular couplings comprise the predetermined portions of the tubular assembly; and wherein the tubular members comprise the other portion of the tubular assembly.

380. The method of claim 378, wherein one or more of the tubular couplings comprise the predetermined portions of the tubular assembly.

381. The method of claim 378, wherein one or more of the tubular members comprise the predetermined portions of the tubular assembly.

382. The method of claim 360, wherein the predetermined portion of the tubular assembly defines one or more openings.

383. The method of claim 382, wherein one or more of the openings comprise slots.

384. The method of claim 382, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1.

385. The method of claim 360, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1.

386. The method of claim 360, wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12.

387. The method of claim 360, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12.

388. The method of claim 360, wherein the predetermined portion of the tubular assembly comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr.

389. The method of claim 388, wherein the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation.

390. The method of claim 388, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

391. The method of claim 388, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.48.

392. The method of claim 360, wherein the predetermined portion of the tubular assembly comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr.

393. The method of claim 392, wherein the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation.

394. The method of claim 392, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

395. The method of claim 392, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.04.

396. The method of claim 360, wherein the predetermined portion of the tubular assembly comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr.

397. The method of claim 396, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.92.

398. The method of claim 360, wherein the predetermined portion of the tubular assembly comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr.

399. The method of claim 398, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.34.

400. The method of claim 360, wherein the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation.

401. The method of claim 360, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

402. The method of claim 360, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.48.

403. The method of claim 360, wherein the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation.

404. The method of claim 360, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

405. The method of claim 360, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.04.

406. The method of claim 360, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.92.

407. The method of claim 360, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.34.

408. The method of claim 360, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92.

409. The method of claim 360, wherein the yield point of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about

47.6 ksi to about 61.7 ksi.

491. The method of claim 360, wherein the expandability coefficient of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is greater than 0.12.

492. The method of claim 360, wherein the expandability coefficient of the predetermined portion of the tubular assembly is greater than the expandability coefficient of the other portion of the tubular assembly.

493. The method of claim 360, wherein the tubular assembly comprises a wellbore casing.

494. The method of claim 360, wherein the tubular assembly comprises a pipeline.

495. The method of claim 360, wherein the tubular assembly comprises a structural support.

496. The apparatus of claim 205, wherein at least a portion of the sleeve is comprised of a frangible material.

497. The apparatus of claim 205, wherein the wall thickness of the sleeve is variable.

498. The method of claim 310, wherein at least a portion of the sleeve is comprised of a frangible material.

499. The method of claim 310, wherein the sleeve comprises a variable wall thickness.

500. The apparatus of claim 205, further comprising:
means for increasing the axial compression loading capacity of the joint between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members.

501. The apparatus of claim 205, further comprising:
means for increasing the axial tension loading capacity of the joint between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members.

502. The apparatus of claim 205, further comprising:
means for increasing the axial compression and tension loading capacity of the joint between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members.

503. The apparatus of claim 205, further comprising:
means for avoiding stress risers in the joint between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members.

504. The apparatus of claim 205, further comprising:
means for inducing stresses at selected portions of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members.

505. The apparatus of claim 205, wherein the sleeve is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed.

506. The method of claim 310, further comprising:
maintaining the sleeve in circumferential tension; and
maintaining the first and second tubular members in circumferential compression.

507. The apparatus of claim 205, wherein the sleeve is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed.

508. The apparatus of claim 205, wherein the sleeve is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed.

509. The method of claim 310, further comprising:
maintaining the sleeve in circumferential tension; and
maintaining the first and second tubular members in circumferential compression.

510. The method of claim 310, further comprising:
maintaining the sleeve in circumferential tension; and
maintaining the first and second tubular members in circumferential compression.

511. The apparatus of claim 500, wherein the means for increasing the axial compression loading capacity of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed.

512. The apparatus of claim 501, wherein the means for increasing the axial tension loading capacity of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed.

513. The apparatus of claim 502, wherein the means for increasing the axial compression and tension loading capacity of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed.

514. The apparatus of claim 503, wherein the means for avoiding stress risers in the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed.

515. The apparatus of claim 504, wherein the means for inducing stresses at selected portions of the coupling between the first and second tubular members before and after a radial expansion and plastic deformation of the first and second tubular members is circumferentially tensioned; and wherein the first and second tubular members are circumferentially compressed.

516. An expandable tubular assembly, comprising:
a first tubular member;
a second tubular member coupled to the first tubular member;
a first threaded connection for coupling a portion of the first and second tubular members;
a second threaded connection spaced apart from the first threaded connection for coupling another portion of the first and second tubular members;

a tubular sleeve coupled to and receiving end portions of the first and second tubular members; and

a sealing element positioned between the first and second spaced apart threaded connections for sealing an interface between the first and second tubular member;

wherein the sealing element is positioned within an annulus defined between the first and second tubular members; and

wherein, prior to a radial expansion and plastic deformation of the assembly, a predetermined portion of the assembly has a lower yield point than another portion of the apparatus.

517. The assembly of claim 516, wherein the predetermined portion of the assembly has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

518. The assembly of claim 516, wherein the predetermined portion of the assembly has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

519. The assembly of claim 516, wherein the predetermined portion of the assembly has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

520. The assembly of claim 516, wherein the predetermined portion of the assembly has a larger inside diameter after the radial expansion and plastic deformation than other portions of the tubular assembly.

521. The assembly of claim 520, further comprising:

positioning another assembly within the preexisting structure in overlapping relation to the assembly; and

radially expanding and plastically deforming the other assembly within the preexisting structure;

wherein, prior to the radial expansion and plastic deformation of the assembly, a predetermined portion of the other assembly has a lower yield point than another portion of the other assembly.

522. The assembly of claim 521, wherein the inside diameter of the radially expanded and

plastically deformed other portion of the assembly is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other assembly.

523. The assembly of claim 516, wherein the predetermined portion of the assembly comprises an end portion of the assembly.

524. The assembly of claim 516, wherein the predetermined portion of the assembly comprises a plurality of predetermined portions of the assembly.

525. The assembly of claim 516, wherein the predetermined portion of the assembly comprises a plurality of spaced apart predetermined portions of the assembly.

526. The assembly of claim 516, wherein the other portion of the assembly comprises an end portion of the assembly.

527. The assembly of claim 516, wherein the other portion of the assembly comprises a plurality of other portions of the assembly.

528. The assembly of claim 516, wherein the other portion of the assembly comprises a plurality of spaced apart other portions of the assembly.

529. The assembly of claim 516, wherein the assembly comprises a plurality of tubular members coupled to one another by corresponding tubular couplings.

530. The assembly of claim 529, wherein the tubular couplings comprise the predetermined portions of the assembly; and wherein the tubular members comprise the other portion of the assembly.

531. The assembly of claim 529, wherein one or more of the tubular couplings comprise the predetermined portions of the assembly.

532. The assembly of claim 529, wherein one or more of the tubular members comprise the predetermined portions of the assembly.

533. The assembly of claim 516, wherein the predetermined portion of the assembly defines one or more openings.

534. The assembly of claim 533, wherein one or more of the openings comprise slots.

535. The assembly of claim 533, wherein the anisotropy for the predetermined portion of the assembly is greater than 1.

536. The assembly of claim 516, wherein the anisotropy for the predetermined portion of the assembly is greater than 1.

537. The assembly of claim 516, wherein the strain hardening exponent for the predetermined portion of the assembly is greater than 0.12.

538. The assembly of claim 516, wherein the anisotropy for the predetermined portion of the assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the assembly is greater than 0.12.

539. The assembly of claim 516, wherein the predetermined portion of the assembly comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr.

540. The assembly of claim 539, wherein the yield point of the predetermined portion of the assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the assembly is at least about 65.9 ksi after the radial expansion and plastic deformation.

541. The assembly of claim 539, wherein the yield point of the predetermined portion of the assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the assembly prior to the radial expansion and plastic deformation.

542. The assembly of claim 539, wherein the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is about 1.48.

543. The assembly of claim 516, wherein the predetermined portion of the assembly comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr.

544. The assembly of claim 543, wherein the yield point of the predetermined portion of

the assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the assembly is at least about 74.4 ksi after the radial expansion and plastic deformation.

545. The assembly of claim 543, wherein the yield point of the predetermined portion of the assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the assembly prior to the radial expansion and plastic deformation.

546. The assembly of claim 543, wherein the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is about 1.04.

547. The assembly of claim 516, wherein the predetermined portion of the assembly comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr.

548. The assembly of claim 547, wherein the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is about 1.92.

549. The assembly of claim 516, wherein the predetermined portion of the assembly comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr.

550. The assembly of claim 549, wherein the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is about 1.34.

551. The assembly of claim 516, wherein the yield point of the predetermined portion of the assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the assembly is at least about 65.9 ksi after the radial expansion and plastic deformation.

552. The assembly of claim 516, wherein the yield point of the predetermined portion of the assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the assembly prior to the radial expansion and plastic deformation.

553. The assembly of claim 516, wherein the anisotropy of the predetermined portion of

the assembly, prior to the radial expansion and plastic deformation, is at least about 1.48.

554. The assembly of claim 516, wherein the yield point of the predetermined portion of the assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the assembly is at least about 74.4 ksi after the radial expansion and plastic deformation.

555. The assembly of claim 516, wherein the yield point of the predetermined portion of the assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the assembly prior to the radial expansion and plastic deformation.

556. The assembly of claim 516, wherein the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is at least about 1.04.

557. The assembly of claim 516, wherein the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is at least about 1.92.

558. The assembly of claim 516, wherein the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is at least about 1.34.

559. The assembly of claim 516, wherein the anisotropy of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92.

560. The assembly of claim 516, wherein the yield point of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, ranges from about 47.6 ksi to about 61.7 ksi.

561. The assembly of claim 516, wherein the expandability coefficient of the predetermined portion of the assembly, prior to the radial expansion and plastic deformation, is greater than 0.12.

562. The assembly of claim 516, wherein the expandability coefficient of the predetermined portion of the assembly is greater than the expandability coefficient of the other portion of the assembly.

563. The assembly of claim 516, wherein the assembly comprises a wellbore casing.

564. The assembly of claim 516, wherein the assembly comprises a pipeline.

565. The assembly of claim 516, wherein the assembly comprises a structural support.

566. The assembly of claim 516, wherein the annulus is at least partially defined by an irregular surface.

567. The assembly of claim 516, wherein the annulus is at least partially defined by a toothed surface.

568. The assembly of claim 516, wherein the sealing element comprises an elastomeric material.

569. The assembly of claim 516, wherein the sealing element comprises a metallic material.

570. The assembly of claim 516, wherein the sealing element comprises an elastomeric and a metallic material.

571. A method of joining radially expandable tubular members comprising:
providing a first tubular member;
providing a second tubular member;
providing a sleeve;
mounting the sleeve for overlapping and coupling the first and second tubular members;
threadably coupling the first and second tubular members at a first location;
threadably coupling the first and second tubular members at a second location spaced apart from the first location;
sealing an interface between the first and second tubular members between the first and second locations using a compressible sealing element, wherein the first tubular member, second tubular member, sleeve, and the sealing element define a tubular assembly; and
radially expanding and plastically deforming the tubular assembly;
wherein, prior to the radial expansion and plastic deformation, a predetermined portion of the tubular assembly has a lower yield point than another portion of

the tubular assembly.

572. The method as defined in claim 571 wherein the sealing element includes an irregular surface.

573. The method as defined in claim 571, wherein the sealing element includes a toothed surface.

574. The method as defined in claim 571, wherein the sealing element comprises an elastomeric material.

575. The method as defined in claim 571, wherein the sealing element comprises a metallic material.

576. The method as defined in claim 571, wherein the sealing element comprises an elastomeric and a metallic material.

577. The method of claim 571, wherein the predetermined portion of the tubular assembly has a higher ductility and a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

578. The method of claim 571, wherein the predetermined portion of the tubular assembly has a higher ductility prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

579. The method of claim 571, wherein the predetermined portion of the tubular assembly has a lower yield point prior to the radial expansion and plastic deformation than after the radial expansion and plastic deformation.

580. The method of claim 571, wherein the predetermined portion of the tubular assembly has a larger inside diameter after the radial expansion and plastic deformation than the other portion of the tubular assembly.

581. The method of claim 571, further comprising:

positioning another tubular assembly within the preexisting structure in overlapping relation to the tubular assembly; and

radially expanding and plastically deforming the other tubular assembly within the

preexisting structure;

wherein, prior to the radial expansion and plastic deformation of the tubular assembly, a predetermined portion of the other tubular assembly has a lower yield point than another portion of the other tubular assembly.

582. The method of claim 581, wherein the inside diameter of the radially expanded and plastically deformed other portion of the tubular assembly is equal to the inside diameter of the radially expanded and plastically deformed other portion of the other tubular assembly.

583. The method of claim 571, wherein the predetermined portion of the tubular assembly comprises an end portion of the tubular assembly.

584. The method of claim 571, wherein the predetermined portion of the tubular assembly comprises a plurality of predetermined portions of the tubular assembly.

585. The method of claim 571, wherein the predetermined portion of the tubular assembly comprises a plurality of spaced apart predetermined portions of the tubular assembly.

586. The method of claim 571, wherein the other portion of the tubular assembly comprises an end portion of the tubular assembly.

587. The method of claim 571, wherein the other portion of the tubular assembly comprises a plurality of other portions of the tubular assembly.

588. The method of claim 571, wherein the other portion of the tubular assembly comprises a plurality of spaced apart other portions of the tubular assembly.

589. The method of claim 571, wherein the tubular assembly comprises a plurality of tubular members coupled to one another by corresponding tubular couplings.

590. The method of claim 589, wherein the tubular couplings comprise the predetermined portions of the tubular assembly; and wherein the tubular members comprise the other portion of the tubular assembly.

591. The method of claim 589, wherein one or more of the tubular couplings comprise the predetermined portions of the tubular assembly.

592. The method of claim 589, wherein one or more of the tubular members comprise the predetermined portions of the tubular assembly.

593. The method of claim 571, wherein the predetermined portion of the tubular assembly defines one or more openings.

594. The method of claim 593, wherein one or more of the openings comprise slots.

595. The method of claim 593, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1.

596. The method of claim 571, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1.

597. The method of claim 571, wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12.

598. The method of claim 571, wherein the anisotropy for the predetermined portion of the tubular assembly is greater than 1; and wherein the strain hardening exponent for the predetermined portion of the tubular assembly is greater than 0.12.

599. The method of claim 571, wherein the predetermined portion of the tubular assembly comprises a first steel alloy comprising: 0.065 % C, 1.44 % Mn, 0.01 % P, 0.002 % S, 0.24 % Si, 0.01 % Cu, 0.01 % Ni, and 0.02 % Cr.

600. The method of claim 599, wherein the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation.

601. The method of claim 599, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

602. The method of claim 599, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.48.

603. The method of claim 571, wherein the predetermined portion of the tubular assembly comprises a second steel alloy comprising: 0.18 % C, 1.28 % Mn, 0.017 % P, 0.004 % S, 0.29 % Si, 0.01 % Cu, 0.01 % Ni, and 0.03 % Cr.

604. The method of claim 603, wherein the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation.

605. The method of claim 603, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

606. The method of claim 603, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.04.

607. The method of claim 571, wherein the predetermined portion of the tubular assembly comprises a third steel alloy comprising: 0.08 % C, 0.82 % Mn, 0.006 % P, 0.003 % S, 0.30 % Si, 0.16 % Cu, 0.05 % Ni, and 0.05 % Cr.

608. The method of claim 607, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.92.

609. The method of claim 571, wherein the predetermined portion of the tubular assembly comprises a fourth steel alloy comprising: 0.02 % C, 1.31 % Mn, 0.02 % P, 0.001 % S, 0.45 % Si, 9.1 % Ni, and 18.7 % Cr.

610. The method of claim 609, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is about 1.34.

611. The method of claim 571, wherein the yield point of the predetermined portion of the tubular assembly is at most about 46.9 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 65.9 ksi after the radial expansion and plastic deformation.

612. The method of claim 571, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 40 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

613. The method of claim 571, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.48.

614. The method of claim 571, wherein the yield point of the predetermined portion of the tubular assembly is at most about 57.8 ksi prior to the radial expansion and plastic deformation; and wherein the yield point of the predetermined portion of the tubular assembly is at least about 74.4 ksi after the radial expansion and plastic deformation.

615. The method of claim 571, wherein the yield point of the predetermined portion of the tubular assembly after the radial expansion and plastic deformation is at least about 28 % greater than the yield point of the predetermined portion of the tubular assembly prior to the radial expansion and plastic deformation.

616. The method of claim 571, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.04.

617. The method of claim 571, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.92.

618. The method of claim 571, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is at least about 1.34.

619. The method of claim 571, wherein the anisotropy of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about 1.04 to about 1.92.

620. The method of claim 571, wherein the yield point of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, ranges from about

47.6 ksi to about 61.7 ksi.

621. The method of claim 571, wherein the expandability coefficient of the predetermined portion of the tubular assembly, prior to the radial expansion and plastic deformation, is greater than 0.12.

622. The method of claim 571, wherein the expandability coefficient of the predetermined portion of the tubular assembly is greater than the expandability coefficient of the other portion of the tubular assembly.

623. The method of claim 571, wherein the tubular assembly comprises a wellbore casing.

624. The method of claim 571, wherein the tubular assembly comprises a pipeline.

625. The method of claim 571, wherein the tubular assembly comprises a structural support.

626. The apparatus of claim 205, wherein the sleeve comprises:
a plurality of spaced apart tubular sleeves coupled to and receiving end portions of the first and second tubular members.

627. The apparatus of claim 626, wherein the first tubular member comprises a first threaded connection; wherein the second tubular member comprises a second threaded connection; wherein the first and second threaded connections are coupled to one another; wherein at least one of the tubular sleeves is positioned in opposing relation to the first threaded connection; and wherein at least one of the tubular sleeves is positioned in opposing relation to the second threaded connection.

628. The apparatus of claim 626, wherein the first tubular member comprises a first threaded connection; wherein the second tubular member comprises a second threaded connection; wherein the first and second threaded connections are coupled to one another; and wherein at least one of the tubular sleeves is not positioned in opposing relation to the first and second threaded connections.

629. The method of claim 310, further comprising:
threadably coupling the first and second tubular members at a first location;

threadably coupling the first and second tubular members at a second location spaced apart from the first location;

providing a plurality of sleeves; and

mounting the sleeves at spaced apart locations for overlapping and coupling the first and second tubular members.

630. The method of claim 629, wherein at least one of the tubular sleeves is positioned in opposing relation to the first threaded coupling; and wherein at least one of the tubular sleeves is positioned in opposing relation to the second threaded coupling.

631. The method of claim 629, wherein at least one of the tubular sleeves is not positioned in opposing relation to the first and second threaded couplings.

632. The apparatus of claim 205, further comprising:

a threaded connection for coupling a portion of the first and second tubular members; wherein at least a portion of the threaded connection is upset.

633. The apparatus of claim 632, wherein at least a portion of tubular sleeve penetrates the first tubular member.

634. The method of claim 310, further comprising:

threadably coupling the first and second tubular members; and

upsetting the threaded coupling.

635. The apparatus of claim 205, wherein the first tubular member further comprises an annular extension extending therefrom; and wherein the flange of the sleeve defines an annular recess for receiving and mating with the annular extension of the first tubular member.

636. The method of claim 310, wherein the first tubular member further comprises an annular extension extending therefrom; and wherein the flange of the sleeve defines an annular recess for receiving and mating with the annular extension of the first tubular member.

637. The apparatus of claim 205, further comprising:

one or more stress concentrators for concentrating stresses in the joint.

638. The apparatus as defined in claim 637, wherein one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member.

639. The apparatus as defined in claim 637, wherein one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member.

640. The apparatus as defined in claim 637, wherein one or more of the stress concentrators comprises one or more openings defined in the sleeve.

641. The apparatus as defined in claim 637, wherein one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member; and wherein one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member.

642. The apparatus as defined in claim 637, wherein one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member; and wherein one or more of the stress concentrators comprises one or more openings defined in the sleeve.

643. The apparatus as defined in claim 637, wherein one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member; and wherein one or more of the stress concentrators comprises one or more openings defined in the sleeve.

644. The apparatus as defined in claim 637, wherein one or more of the stress concentrators comprises one or more external grooves defined in the first tubular member; wherein one or more of the stress concentrators comprises one or more internal grooves defined in the second tubular member; and wherein one or more of the stress concentrators comprises one or more openings defined in the sleeve.

645. The method of claim 310, further comprising:
concentrating stresses within the joint.

646. The method as defined in claim 645, wherein concentrating stresses within the joint comprises using the first tubular member to concentrate stresses within the joint.

647. The method as defined in claim 645, wherein concentrating stresses within the joint comprises using the second tubular member to concentrate stresses within the joint.

648. The method as defined in claim 645, wherein concentrating stresses within the joint comprises using the sleeve to concentrate stresses within the joint.

649. The method as defined in claim 645, wherein concentrating stresses within the joint comprises using the first tubular member and the second tubular member to concentrate stresses within the joint.

650. The method as defined in claim 645, wherein concentrating stresses within the joint comprises using the first tubular member and the sleeve to concentrate stresses within the joint.

651. The method as defined in claim 645, wherein concentrating stresses within the joint comprises using the second tubular member and the sleeve to concentrate stresses within the joint.

652. The method as defined in claim 645, wherein concentrating stresses within the joint comprises using the first tubular member, the second tubular member, and the sleeve to concentrate stresses within the joint.

653. The apparatus of claim 205, further comprising:
means for maintaining portions of the first and second tubular member in circumferential compression following the radial expansion and plastic deformation of the first and second tubular members.

654. The apparatus of claim 205, further comprising:
means for concentrating stresses within the mechanical connection during the radial expansion and plastic deformation of the first and second tubular members.

655. The apparatus of claim 205, further comprising:
means for maintaining portions of the first and second tubular member in circumferential compression following the radial expansion and plastic deformation of the first and second tubular members; and

means for concentrating stresses within the mechanical connection during the radial expansion and plastic deformation of the first and second tubular members.

656. The method of claim 310, further comprising:
maintaining portions of the first and second tubular member in circumferential compression following a radial expansion and plastic deformation of the first and second tubular members.

657. The method of claim 310, further comprising:
concentrating stresses within the joint during a radial expansion and plastic deformation of the first and second tubular members.

658. The method of claim 310, further comprising:
maintaining portions of the first and second tubular member in circumferential compression following a radial expansion and plastic deformation of the first and second tubular members; and
concentrating stresses within the joint during a radial expansion and plastic deformation of the first and second tubular members.

659. The method of claim 1, wherein the carbon content of the predetermined portion of the tubular assembly is less than or equal to 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.21.

660. The method of claim 1, wherein the carbon content of the predetermined portion of the tubular assembly is greater than 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.36.

661. An expandable tubular member, wherein the carbon content of the tubular member is less than or equal to 0.12 percent; and wherein the carbon equivalent value for the tubular member is less than 0.21.

662. The tubular member of claim 661, wherein the tubular member comprises a wellbore casing.

663. An expandable tubular member, wherein the carbon content of the tubular member is greater than 0.12 percent; and wherein the carbon equivalent value for the tubular member is less than 0.36.

664. The tubular member of claim 663, wherein the tubular member comprises a wellbore casing.

665. The apparatus of claim 142, wherein the carbon content of the predetermined portion of the tubular assembly is less than or equal to 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.21.

666. The apparatus of claim 142, wherein the carbon content of the predetermined portion of the tubular assembly is greater than 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.36.

667. A method of selecting tubular members for radial expansion and plastic deformation, comprising:

selecting a tubular member from a collection of tubular member;

determining a carbon content of the selected tubular member;

determining a carbon equivalent value for the selected tubular member; and

if the carbon content of the selected tubular member is less than or equal to 0.12 percent and the carbon equivalent value for the selected tubular member is less than 0.21, then determining that the selected tubular member is suitable for radial expansion and plastic deformation.

668. A method of selecting tubular members for radial expansion and plastic deformation, comprising:

selecting a tubular member from a collection of tubular member;

determining a carbon content of the selected tubular member;

determining a carbon equivalent value for the selected tubular member; and

if the carbon content of the selected tubular member is greater than 0.12 percent and the carbon equivalent value for the selected tubular member is less than 0.36, then determining that the selected tubular member is suitable for radial expansion and plastic deformation.

669. The apparatus of claim 205, wherein the carbon content of the predetermined portion of the apparatus is less than or equal to 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the apparatus is less than 0.21.

670. The apparatus of claim 205, wherein the carbon content of the predetermined portion of the apparatus is greater than 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the apparatus is less than 0.36.

671. The method of claim 310, wherein the carbon content of the predetermined portion of the tubular assembly is less than or equal to 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.21.

672. The method of claim 310, wherein the carbon content of the predetermined portion of the tubular assembly is greater than 0.12 percent; and wherein the carbon equivalent value for the predetermined portion of the tubular assembly is less than 0.36.

673. An expandable tubular member, comprising:
a tubular body;
wherein a yield point of an inner tubular portion of the tubular body is less than a yield point of an outer tubular portion of the tubular body.

674. The expandable tubular member of claim 673, wherein the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body.

675. The expandable tubular member of claim 674, wherein the yield point of the inner tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body.

676. The expandable tubular member of claim 674, wherein the yield point of the inner tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body.

677. The expandable tubular member of claim 673, wherein the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body.

678. The expandable tubular member of claim 677, wherein the yield point of the outer tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body.

679. The expandable tubular member of claim 677, wherein the yield point of the outer tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body.

680. The expandable tubular member of claim 673,
wherein the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body; and
wherein the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body.

681. The expandable tubular member of claim 680, wherein the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body.

682. The expandable tubular member of claim 680, wherein the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body.

683. The expandable tubular member of claim 680, wherein the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body.

684. The expandable tubular member of claim 680, wherein the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body.

685. The expandable tubular member of claim 680, wherein the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body.

686. The expandable tubular member of claim 680, wherein the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body.

687. The method of claim 1, wherein a yield point of an inner tubular portion of at least a portion of the tubular assembly is less than a yield point of an outer tubular portion of the portion of the tubular assembly.

688. The method of claim 687, wherein the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body.

689. The method of claim 688, wherein the yield point of the inner tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body.

690. The method of claim 688, wherein the yield point of the inner tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body.

691. The method of claim 687, wherein the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body.

692. The method of claim 691, wherein the yield point of the outer tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body.

693. The method of claim 691, wherein the yield point of the outer tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body.

694. The method of claim 687, wherein the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body.

695. The method of claim 694, wherein the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body.

696. The method of claim 694, wherein the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body.

697. The method of claim 694, wherein the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body.

698. The method of claim 694, wherein the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body.

699. The method of claim 694, wherein the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body.

700. The method of claim 694, wherein the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body.

701. The apparatus of claim 142, wherein a yield point of an inner tubular portion of at least a portion of the tubular assembly is less than a yield point of an outer tubular portion of the portion of the tubular assembly.

702. The apparatus of claim 701, wherein the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body.

703. The apparatus of claim 702, wherein the yield point of the inner tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body.

704. The apparatus of claim 702, wherein the yield point of the inner tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body.

705. The apparatus of claim 701, wherein the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body.

706. The apparatus of claim 705, wherein the yield point of the outer tubular portion of the tubular body varies in an linear fashion as a function of the radial position within the tubular body.

707. The apparatus of claim 705, wherein the yield point of the outer tubular portion of the tubular body varies in an non-linear fashion as a function of the radial position within the tubular body.

708. The apparatus of claim 701, wherein the yield point of the inner tubular portion of the tubular body varies as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies as a function of the radial position within the tubular body.

709. The apparatus of claim 708, wherein the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body.

710. The apparatus of claim 708, wherein the yield point of the inner tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body.

711. The apparatus of claim 708, wherein the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the

tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a linear fashion as a function of the radial position within the tubular body.

712. The apparatus of claim 708, wherein the yield point of the inner tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body; and wherein the yield point of the outer tubular portion of the tubular body varies in a non-linear fashion as a function of the radial position within the tubular body.

713. The apparatus of claim 708, wherein the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body.

714. The apparatus of claim 708, wherein the rate of change of the yield point of the inner tubular portion of the tubular body is different than the rate of change of the yield point of the outer tubular portion of the tubular body.

715. The method of claim 1, wherein prior to the radial expansion and plastic deformation, at least a portion of the tubular assembly comprises a microstructure comprising a hard phase structure and a soft phase structure.

716. The method of claim 715, wherein prior to the radial expansion and plastic deformation, at least a portion of the tubular assembly comprises a microstructure comprising a transitional phase structure.

717. The method of claim 715, wherein the hard phase structure comprises martensite.

718. The method of claim 715, wherein the soft phase structure comprises ferrite.

719. The method of claim 715, wherein the transitional phase structure comprises retained austentite.

720. The method of claim 715, wherein the hard phase structure comprises martensite; wherein the soft phase structure comprises ferrite; and wherein the transitional phase structure comprises retained austentite.

721. The method of claim 715, wherein the portion of the tubular assembly comprising a microstructure comprising a hard phase structure and a soft phase structure comprises, by weight percentage, about 0.1% C, about 1.2% Mn, and about 0.3% Si.

722. The apparatus of claim 142, wherein at least a portion of the tubular assembly comprises a microstructure comprising a hard phase structure and a soft phase structure.

723. The apparatus of claim 722, wherein prior to the radial expansion and plastic deformation, at least a portion of the tubular assembly comprises a microstructure comprising a transitional phase structure.

724. The apparatus of claim 722, wherein the hard phase structure comprises martensite.

725. The apparatus of claim 722, wherein the soft phase structure comprises ferrite.

726. The apparatus of claim 722, wherein the transitional phase structure comprises retained austentite.

727. The apparatus of claim 722, wherein the hard phase structure comprises martensite; wherein the soft phase structure comprises ferrite; and wherein the transitional phase structure comprises retained austentite.

728. The apparatus of claim 722, wherein the portion of the tubular assembly comprising a microstructure comprising a hard phase structure and a soft phase structure comprises, by weight percentage, about 0.1% C, about 1.2% Mn, and about 0.3% Si.

729. A method of manufacturing an expandable tubular member, comprising:
providing a tubular member;
heat treating the tubular member; and
quenching the tubular member;
wherein following the quenching, the tubular member comprises a microstructure comprising a hard phase structure and a soft phase structure.

730. The method of claim 729, wherein the provided tubular member comprises, by weight percentage, 0.065% C, 1.44% Mn, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.05% V, 0.01% Mo, 0.01% Nb, and 0.01%Ti.

731. The method of claim 729, wherein the provided tubular member comprises, by weight percentage, 0.18% C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.04% V, 0.01% Mo, 0.03% Nb, and 0.01%Ti.

732. The method of claim 729, wherein the provided tubular member comprises, by weight percentage, 0.08% C, 0.82% Mn, 0.006% P, 0.003% S, 0.30% Si, 0.06% Cu, 0.05% Ni, 0.05% Cr, 0.03% V, 0.03% Mo, 0.01% Nb, and 0.01%Ti.

733. The method of claim 729, wherein the provided tubular member comprises a microstructure comprising one or more of the following: martensite, pearlite, vanadium carbide, nickel carbide, or titanium carbide.

734. The method of claim 729, wherein the provided tubular member comprises a microstructure comprising one or more of the following: pearlite or pearlite striation.

735. The method of claim 729, wherein the provided tubular member comprises a microstructure comprising one or more of the following: grain pearlite, widmanstatten martensite, vanadium carbide, nickel carbide, or titanium carbide.

736. The method of claim 729, wherein the heat treating comprises heating the provided tubular member for about 10 minutes at 790 °C.

737. The method of claim 729, wherein the quenching comprises quenching the heat treated tubular member in water.

738. The method of claim 729, wherein following the quenching, the tubular member comprises a microstructure comprising one or more of the following: ferrite, grain pearlite, or martensite.

739. The method of claim 729, wherein following the quenching, the tubular member comprises a microstructure comprising one or more of the following: ferrite, martensite, or bainite.

740. The method of claim 729, wherein following the quenching, the tubular member comprises a microstructure comprising one or more of the following: bainite, pearlite, or ferrite.

741. The method of claim 729, wherein following the quenching, the tubular member comprises a yield strength of about 67ksi and a tensile strength of about 95 ksi.

742. The method of claim 729, wherein following the quenching, the tubular member comprises a yield strength of about 82 ksi and a tensile strength of about 130 ksi.

743. The method of claim 729, wherein following the quenching, the tubular member comprises a yield strength of about 60 ksi and a tensile strength of about 97 ksi.

744. The method of claim 729, further comprising:
positioning the quenched tubular member within a preexisting structure; and
radially expanding and plastically deforming the tubular member within the preexisting structure.

745. The apparatus of claim 142, wherein at least a portion of the tubular assembly comprises a microstructure comprising a hard phase structure and a soft phase structure.

746. The apparatus of claim 745, wherein the portion of the tubular assembly comprises, by weight percentage, 0.065% C, 1.44% Mn, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.05% V, 0.01% Mo, 0.01% Nb, and 0.01%Ti.

747. The apparatus of claim 745, wherein the portion of the tubular assembly comprises, by weight percentage, 0.18% C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.04% V, 0.01% Mo, 0.03% Nb, and 0.01%Ti.

748. The apparatus of claim 745, wherein the portion of the tubular assembly comprises, by weight percentage, 0.08% C, 0.82% Mn, 0.006% P, 0.003% S, 0.30% Si, 0.06% Cu, 0.05% Ni, 0.05% Cr, 0.03% V, 0.03% Mo, 0.01% Nb, and 0.01%Ti.

749. The apparatus of claim 745, wherein the portion of the tubular assembly comprises a microstructure comprising one or more of the following: martensite, pearlite, vanadium carbide, nickel carbide, or titanium carbide.

750. The apparatus of claim 745, wherein the portion of the tubular assembly comprises a microstructure comprising one or more of the following: pearlite or pearlite striation.

751. The apparatus of claim 745, wherein the portion of the tubular assembly comprises a microstructure comprising one or more of the following: grain pearlite, widmanstatten martensite, vanadium carbide, nickel carbide, or titanium carbide.

752. The apparatus of claim 745, wherein the portion of the tubular assembly comprises a microstructure comprising one or more of the following: ferrite, grain pearlite, or martensite.

753. The apparatus of claim 745, wherein the portion of the tubular assembly comprises a microstructure comprising one or more of the following: ferrite, martensite, or bainite.

754. The apparatus of claim 745, wherein the portion of the tubular assembly comprises a microstructure comprising one or more of the following: bainite, pearlite, or ferrite.

755. The apparatus of claim 745, wherein the portion of the tubular assembly comprises a yield strength of about 67ksi and a tensile strength of about 95 ksi.

756. The apparatus of claim 745, wherein the portion of the tubular assembly comprises a yield strength of about 82 ksi and a tensile strength of about 130 ksi.

757. The apparatus of claim 745, wherein the portion of the tubular assembly comprises a yield strength of about 60 ksi and a tensile strength of about 97 ksi.

758. A method for manufacturing an expandable tubular member comprising:

providing a tubular member;

heat treating the tubular member;

quenching the tubular member; and

cold working the tubular member, whereby upon cold working, the yield strength of the tubular member is increased.

759. The method of claim 758 wherein the tubular member comprises a connection for an expandable tubular member.

760. The method of claim 758 wherein the yield strength increases from approximately 35 ksi to 80 ksi.

761. A method for expanding an expandable tubular member comprising:

providing a tubular member;

lubricating the tubular member; and

expanding the tubular member.

762. The method of claim 761 wherein the tubular member comprises a connection for an expandable tubular member.

763. A method for formability evaluation comprising:

selecting a first tubular member;

measuring a plurality of stress and strain property parameters for the first tubular member;

measuring a Charpy V-notch impact value parameter for the first tubular member;

measuring a stress rupture parameter for the first tubular member;

measuring a strain hardening exponent parameter for the first tubular member;

measuring a plastic strain ratio parameter for the first tubular member;

comparing the parameters measured for first tubular member to a plurality of desired parameters; and

selecting the first tubular member to manufacture an expandable tubular member if the measured parameters meet or exceed the desired parameters.

764. The method of claim 763 wherein the stress rupture parameter includes a parameter for burst.

765. The method of claim 763 wherein the stress rupture parameter includes a parameter for collapse.

766. The method of claim 763 wherein a tubular member with a plastic strain ratio parameter of greater than 1.0 will be more resistant to thinning and better suited to tubular expansion.

767. An expandable tubular member comprising:

a tensile strength in the range of 60 ksi to 120 ksi;

a yield strength in the range of 40 ksi to 100 ksi;

a yield strength to tensile strength ratio in the range of 50% to 85%;

a minimum elongation change due to radial expansion of 35%;

a minimum width reduction due to radial expansion of 40%;

a minimum thickness reduction due to radial expansion of 30%; and
a minimum anisotropy of 1.5.

768. The member of claim 767 further comprising:
a minimum flare expansion of 45%.

769. The member of claim 767 further comprising:
a minimum absorbed energy at negative 4 degrees Fahrenheit of 80 ft-lbs in the longitudinal direction, 60 ft-lbs in the transverse direction, and 60 ft lbs in the transverse weld area.

770. A method for transforming the yield strength of an expandable tubular member comprising:
providing a manufactured tubular member;
cold rolling the tubular member;
inter-critical annealing the tubular member;
expanding the tubular member; and
heating the tubular member.

771. The method of claim 770 wherein the tubular member comprises a dual steel composition comprising, by weight percentage, 0.12%C, 0.4%Si, 1.5% Mn, and 0.02%Nb.

772. An expandable tubular member comprising:
a tensile strength in the range of 80 ksi to 100 ksi;
a yield strength in the range of 60 ksi to 90 ksi;
a maximum yield strength to tensile strength ratio of 85%;
a minimum elongation change due to radial expansion of 22%;
a minimum width reduction due to radial expansion of 30%;
a minimum thickness reduction due to radial expansion of 35%; and
a minimum anisotropy of 0.8.

773. The member of claim 772 further comprising:
a minimum flare expansion of 45%.

774. The member of claim 772 further comprising:

a minimum absorbed energy at negative 4 degrees Fahrenheit of 80 ft-lbs in a longitudinal direction, 60 ft-lbs in a transverse direction, and 60 ft lbs in a transverse weld area.

775. An expandable tubular member comprising:

a tensile strength in the range of 60 ksi to 120 ksi;
a yield strength in the range of 40 ksi to 100 ksi;
a yield strength to tensile strength ratio in the range of 50% to 85%;
a minimum elongation change due to radial expansion of 35%;
a minimum width reduction due to radial expansion of 40%;
a minimum thickness reduction due to radial expansion of 30%; and
a minimum anisotropy of 1.5.

776. The member of claim 775 further comprising:

a minimum flare expansion of 75%.

777. The member of claim 775 further comprising:

a minimum absorbed energy at negative 4 degrees Fahrenheit of 80 ft-lbs in a longitudinal direction, 60 ft-lbs in a transverse direction, and 60 ft lbs in a transverse weld area.

778. A method for transforming the yield strength of an expandable tubular member comprising:

providing a manufactured tubular member;
inter-critical annealing the tubular member;
expanding the tubular member; and
heating the tubular member.

779. An expandable tubular member comprising:

a yield strength of approximately 77 ksi;
a tensile strength of approximately 83 ksi; and
an elongation of approximately 32%.

780. An expansion device comprising:

a surface;
a self lubricating hard coating on the surface; and
a self lubricating soft coating on the surface.

781. The device of claim 780 wherein the self-lubricating soft coating comprises film grease.

782. The device of claim 780 wherein the self lubricating soft coating comprises a lubricated mud.

783. The device of claim 780 wherein the self lubricating soft coating comprises a film grease and a lubricated mud.

784. The device of claim 780 wherein the member comprises a friction coefficient of not more than 0.05.

785. The device of claim 780 wherein the member comprises a friction coefficient of approximately 0.05.

786. The device of claim 780 wherein the member comprises a friction coefficient of approximately 0.075.

787. The device of claim 780 wherein the member comprises a friction coefficient of approximately 0.1.

788. The device of claim 780 wherein the member comprises a friction coefficient of approximately 0.125.

789. An expandable tubular member comprising:

a yield strength in the range of 40 ksi to 80 ksi;
a maximum yield strength to tensile strength ratio of 0.5;
a minimum elongation change due to radial expansion of 30%;
a minimum width reduction due to radial expansion of 45%;
a minimum wall thickness reduction due to radial expansion of 30%; and
a minimum anisotropy of 1.5.

790. An expandable tubular member comprising:

a friction coefficient of 0.02, whereby the member may be expanded by a force below 100000 lbs.

791. The member of claim 790 wherein the member has approximately a 6 inch diameter.

792. An expandable tubular member comprising:

a lubricant resulting in a friction coefficient of 0.125;

a wall thickness of approximately 0.305 inches; and

a required expansion force of approximately 146000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 25 and a collapse strength of approximately 2400 ksi.

793. An expandable tubular member comprising:

a lubricant resulting in a friction coefficient of 0.0.075;

a wall thickness of approximately 0.350 inches; and

a required expansion force of approximately 143000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 22 and a collapse strength of approximately 3250 ksi.

794. An expandable tubular member comprising:

a lubricant resulting in a friction coefficient of 0.02;

a wall thickness of approximately 0.450 inches; and

a required expansion force of approximately 150000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 17 and a collapse strength of approximately 5800 ksi.

795. An expandable tubular member comprising:

a lubricant resulting in a friction coefficient of 0.02;

a wall thickness of approximately 0.5 inches; and

a required expansion force of approximately 126000 lbs, wherein the expansion force allows a diameter to thickness ratio of approximately 15 and a collapse strength of approximately 5350 ksi.

796. The member of claim 795 wherein the member includes a 55 ksi steel.

797. An expandable tubular member comprising:

a lubricant resulting in a friction coefficient of 0.02;

a wall thickness of approximately 0.5 inches; and

a required expansion force of approximately 127000 lbs, wherein the expansion force results in a diameter to thickness ratio of approximately 15 and a collapse strength of approximately 8400 ksi.

798. The member of claim 797 wherein the member includes a steel with a 55 ksi yield before expansion and a 100 ksi yield after expansion.

799. An expandable tubular member comprising:

a composition, by weight percentage, of 0.065% C, 1.44% Mn, 0.01% P, 0.002% S, 0.24% Si, 0.01% Cu, 0.01% Ni, 0.02% Cr, 0.04% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti.

800. An expandable tubular member comprising:

a composition, by weight percentage, of 0.18% C, 1.28% Mn, 0.017% P, 0.004% S, 0.29% Si, 0.01% Cu, 0.01% Ni, 0.03% Cr, 0.03% V, 0.03% Mo, 0.01% Nb, and 0.01% Ti.

801. An expandable tubular member comprising:

a composition, by weight percentage, of 0.08% C, 0.82% Mn, 0.006% P, 0.003% S, 0.3% Si, 0.16% Cu, 0.05% Ni, 0.05% Cr, 0.06% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti.

802. An expandable tubular member comprising:

a composition, by weight percentage, of 0.03% C, 1.48% Mn, 0.014% P, 0.002% S, 0.16% Si, 0.02% Cu, 0.01% Ni, 0.02% Cr, 0.06% V, 0.01% Mo, 0.03% Nb, and 0.01% Ti.

803. An expandable tubular member comprising:

after a 16% expansion, approximately a 21% change in yield strength, approximately a 24% change in yield ratio, approximately a 18% change in elongation percentage, approximately a 8% change in width reduction percentage, approximately a 15% change in wall thickness reduction percentage, and approximately a 4% change in anisotropy.

804. An expandable tubular member comprising:

after a 15.6% expansion, approximately a 70% change in yield strength, approximately a 25% change in yield ratio, approximately a 67% change in elongation

percentage, approximately a 28% change in width reduction percentage, approximately a 7% change in wall thickness reduction percentage, and approximately a 75% change in anisotropy.

805. An expandable tubular member comprising:

after a 24% expansion, approximately a 5% change in yield strength, approximately a 11% change in yield ratio, approximately a 20% change in elongation percentage, approximately a 43% change in width reduction percentage, approximately a 2% change in wall thickness reduction percentage, and approximately a 52% change in anisotropy.

806. An expandable tubular member comprising:

after a 24% expansion, approximately a 10% change in yield strength, approximately a 3% change in yield ratio, approximately a 30% change in elongation percentage, approximately a 13% change in width reduction percentage, approximately a 2% change in wall thickness reduction percentage, and approximately a 17% change in anisotropy.

807. An expandable tubular member comprising:

after a 24% expansion, approximately a 46% change in yield strength, approximately a 20% change in yield ratio, approximately a 91% change in elongation percentage, approximately a 15% change in width reduction percentage, approximately a 2% change in wall thickness reduction percentage, and approximately a 18% change in anisotropy.

808. An expandable tubular member comprising:

after a 16% expansion, approximately a 38% change in yield strength, approximately a 20% change in yield ratio, approximately a 11% change in elongation percentage, approximately a 9% change in width reduction percentage, approximately a 4% change in wall thickness reduction percentage, and approximately a 4% change in anisotropy.

809. An expandable tubular member comprising:

after a 24% expansion, approximately a 31% change in yield strength, approximately a 14% change in yield ratio, approximately a 48% change in elongation percentage, approximately a 13% change in width reduction percentage, approximately a

2% change in wall thickness reduction percentage, and approximately a 12% change in anisotropy.

810. An expandable tubular member comprising:

after a 24% expansion, approximately a 38% change in yield strength, approximately a 21% change in yield ratio, approximately a 55% change in elongation percentage, approximately a 16% change in width reduction percentage, approximately a 9% change in wall thickness reduction percentage, and approximately a 13% change in anisotropy.

811. An expandable tubular member comprising:

after a 16% expansion, approximately a 33% change in yield strength, approximately a 26% change in yield ratio, approximately a 30% change in elongation percentage, approximately a 15% change in width reduction percentage, approximately a 9% change in wall thickness reduction percentage, and approximately a 10% change in anisotropy.

812. An expandable tubular member comprising:

after a 24% expansion, approximately a 41% change in yield strength, approximately a 27 % change in yield ratio, approximately a 40% change in elongation percentage, approximately a 21% change in width reduction percentage, approximately a 16% change in wall thickness reduction percentage, and approximately a 5% change in anisotropy.

813. An expandable tubular member comprising:

a tensile strength of approximately 68 ksi before radial expansion;
a tensile strength of approximately 80 ksi after 16% radial expansion; and
a tensile strength of approximately 82 ksi after 24% radial expansion.

814. An expandable tubular member comprising:

a tensile strength of approximately 69 ksi before radial expansion;
a tensile strength of approximately 82 ksi after 16% radial expansion; and
a tensile strength of approximately 88 ksi after 24% radial expansion.

815. An expandable tubular member comprising:

a tensile strength of approximately 80 ksi before radial expansion;
a tensile strength of approximately 90 ksi after 16% radial expansion; and

a tensile strength of approximately 92 ksi after 24% radial expansion.

816. An expandable tubular member comprising:

a tensile strength of approximately 115 ksi before radial expansion;

a tensile strength of approximately 120 ksi after 15.2% radial expansion; and

a tensile strength of approximately 121 ksi after 25.2% radial expansion.

817. An expandable tubular member comprising:

a tensile strength of approximately 100 ksi before radial expansion; and

a tensile strength of approximately 26 ksi after 31.3% radial expansion.

818. An expandable tubular member comprising:

a tensile strength of approximately 114 ksi before radial expansion; and

a tensile strength of approximately 140 ksi after 15.6% radial expansion.

819. An expandable tubular member comprising:

upon quenching in water at approximately 775 °C, a tensile strength of 94 ksi and a yield strength of 56 ksi.

820. An expandable tubular member comprising:

upon quenching in water at approximately 790 °C, a tensile strength of 94 ksi and a yield strength of 59 ksi.

821. An expandable tubular member comprising:

upon quenching in water at approximately 735 °C, a tensile strength of 94 ksi and a yield strength of 59 ksi.

822. An expandable tubular member comprising:

upon quenching in oil at approximately 775 °C, a tensile strength of 84 ksi and a yield strength of 49 ksi.

823. An expandable tubular member comprising:

upon quenching in oil at approximately 820 °C, a tensile strength of 92 ksi and a yield strength of 61 ksi.

824. An expandable tubular member comprising:

upon quenching in oil at approximately 750 °C, a tensile strength of 109 ksi and a yield strength of 58 ksi.

825. An expandable tubular member comprising:

by weight percentage, 0.1% C, 1.5% Mn, and 0.3% Si.

826. The member of claim 822 further comprising:

martensite in the range of 15% to 30%.

827. An expandable tubular member comprising:

a yield strength of approximately 80 ksi, a yield strength to tensile strength ratio of approximately 0.86, a longitudinal elongation change due to radial expansion of approximately 14.8%, a width reduction due to radial expansion of approximately 38%, a wall thickness reduction due to radial expansion of approximately 43%, and an anisotropy of approximately 0.87.

828. An expandable tubular member comprising:

a yield strength of approximately 81 ksi, a yield strength to tensile strength ratio of approximately 0.83, a longitudinal elongation change due to radial expansion of approximately 14.9%, a width reduction due to radial expansion of approximately 38%, a wall thickness reduction due to radial expansion of approximately 43%, and an anisotropy of approximately 0.83.

829. An expandable tubular member comprising:

a yield strength of approximately 79 ksi, a yield strength to tensile strength ratio of approximately 0.82, a longitudinal elongation change due to radial expansion of approximately 15.9%, a width reduction due to radial expansion of approximately 44%, a wall thickness reduction due to radial expansion of approximately 43%, and an anisotropy of approximately 1.03.

830. An expandable tubular member comprising:

a yield strength of approximately 80 ksi, a yield strength to tensile strength ratio of approximately 0.83, a longitudinal elongation change due to radial expansion of approximately 15.3%, a width reduction due to radial expansion of approximately 40%, a wall thickness reduction due to radial expansion of approximately 43%, and an anisotropy of approximately 0.92.

831. An expandable tubular member comprising:

an elongation change due to radial expansion of approximately 21%, a width reduction due to radial expansion of approximately 35%, a wall thickness reduction due to radial expansion of approximately 38%, and an anisotropy of approximately 0.89.

832. An expandable tubular member comprising:

a yield strength of approximately 77 ksi, a yield strength to tensile strength ratio of approximately 0.82, a longitudinal elongation change due to radial expansion of approximately 16%, a width reduction due to radial expansion of approximately 32%, a wall thickness reduction due to radial expansion of approximately 45%, and an anisotropy of approximately 0.65.

833. An expandable tubular member comprising:

a yield strength of approximately 78 ksi, a yield strength to tensile strength ratio of approximately 0.8, a longitudinal elongation change due to radial expansion of approximately 16%, a width reduction due to radial expansion of approximately 31%, a wall thickness reduction due to radial expansion of approximately 45%, and an anisotropy of approximately 0.63.

834. An expandable tubular member, upon quenching and tempering, comprising:

a yield strength of approximately 84 ksi, a yield strength to tensile strength ratio of approximately 0.84, a longitudinal elongation change due to radial expansion of approximately 20.5%, a width reduction due to radial expansion of approximately 40%, a wall thickness reduction due to radial expansion of approximately 42%, and an anisotropy of approximately 0.94.

835. An expandable tubular member comprising:

a yield strength of approximately 80 ksi, a yield strength to tensile strength ratio of approximately 0.72, an elongation change due to radial expansion of approximately 35%, a width reduction due to radial expansion of approximately 35%, a wall thickness reduction due to radial expansion of approximately 33%, and an anisotropy of approximately 0.92.

836. The member of claim 835 wherein the member is processed comprising the steps of hot stretching, reducing at approximately 1950 °C, and rotary straightening.

837. An expandable tubular member comprising:

a yield strength of approximately 90 ksi, a yield strength to tensile strength ratio of approximately 0.88, an elongation change due to radial expansion of approximately 25%, a width reduction due to radial expansion of approximately 22%, a wall thickness reduction due to radial expansion of approximately 20%, and an anisotropy of approximately 1.1.

838. The member of claim 837 wherein the member is processed comprising the steps of normalization at approximately 1850 °C, cold drawing, annealing at approximately 1050 °C, and rotary straightening.

839. An expandable tubular member comprising:

a yield strength of approximately 88 ksi, a yield strength to tensile strength ratio of approximately 0.87, an elongation change due to radial expansion of approximately 16%, a width reduction due to radial expansion of approximately 24%, a wall thickness reduction due to radial expansion of approximately 30%, and an anisotropy of approximately 0.76.

840. The member of claim 839 wherein the member is processed comprising the steps of hot stretching, reducing at approximately 1950 °C, cold drawing, annealing, and rotary straightening.

841. An expandable tubular member comprising:

a yield strength of approximately 48 ksi, a yield strength to tensile strength ratio of approximately 0.73, an elongation change due to radial expansion of approximately 38%, a width reduction due to radial expansion of approximately 43%, a wall thickness reduction due to radial expansion of approximately 49%, and an anisotropy of approximately 0.83.

842. The member of claim 841 wherein the member is processed comprising the steps of hot stretching, reducing at approximately 1850 °C, and rotary straightening.

843. An expandable tubular member comprising:

a yield strength of approximately 46 ksi, a yield strength to tensile strength ratio of approximately 0.69, an elongation change due to radial expansion of approximately 40%, a width reduction due to radial expansion of approximately 50%, a wall thickness reduction due to radial expansion of approximately 53%, and an anisotropy of approximately 0.93.

844. The member of claim 843 wherein the member is processed comprising the steps of hot reducing at approximately 1850 °C, cold sizing, and rotary straightening.

845. An expandable tubular member comprising:

a yield strength of approximately 53 ksi, a yield strength to tensile strength ratio of approximately 0.85, an elongation change due to radial expansion of approximately 49%, a width reduction due to radial expansion of approximately 49%, a wall thickness reduction due to radial expansion of approximately 46%, and an anisotropy of approximately 1.1.

846. The member of claim 845 wherein the member is processed comprising the steps of hot stretching, reducing at approximately 1850 °C, and rotary straightening.

847. An expandable tubular member, upon quenching and tempering, comprising:

after a flare expansion of 42%, an absorbed energy in the longitudinal direction of 125, an absorbed energy in the transverse direction of 59 ft-lbs, and an absorbed energy in the weld of 176 ft-lbs.

848. An expandable tubular member, upon quenching and tempering, comprising:

after a flare expansion of 52%, an absorbed energy in the longitudinal direction of 145 ft-lbs, an absorbed energy in the transverse direction of 59, and an absorbed energy in the weld of 174 ft-lbs.

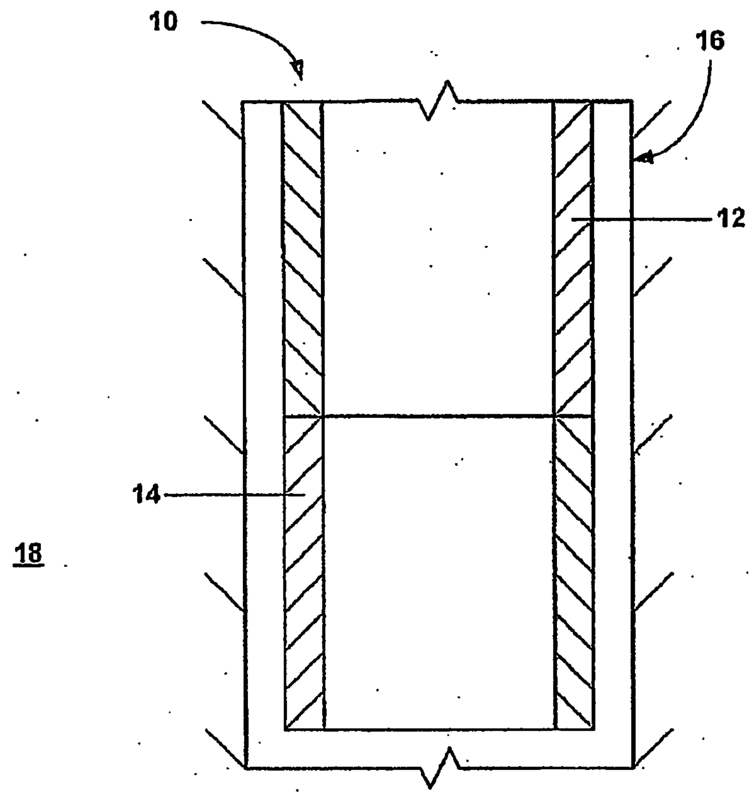


FIG. 1

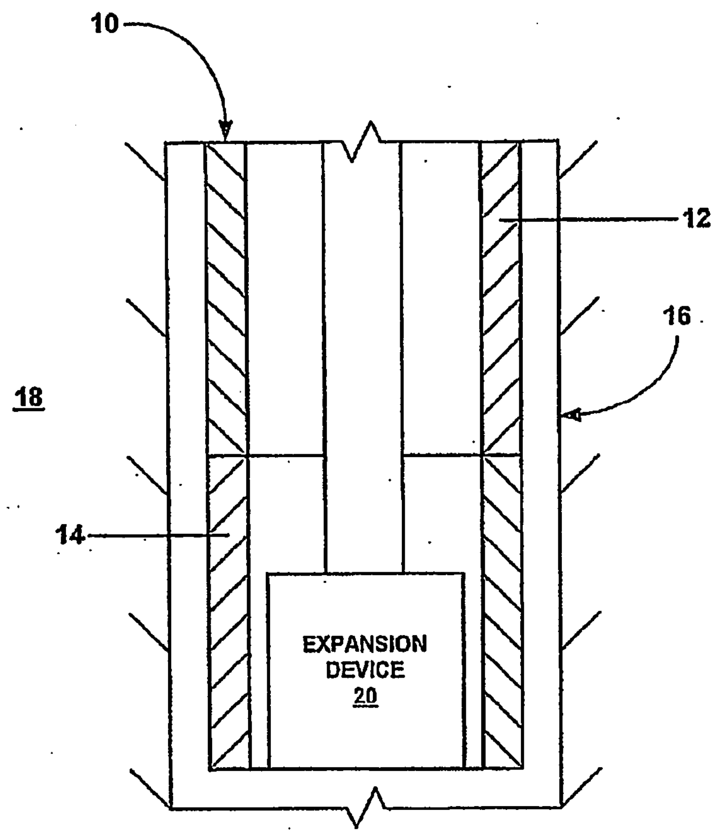


FIG. 2

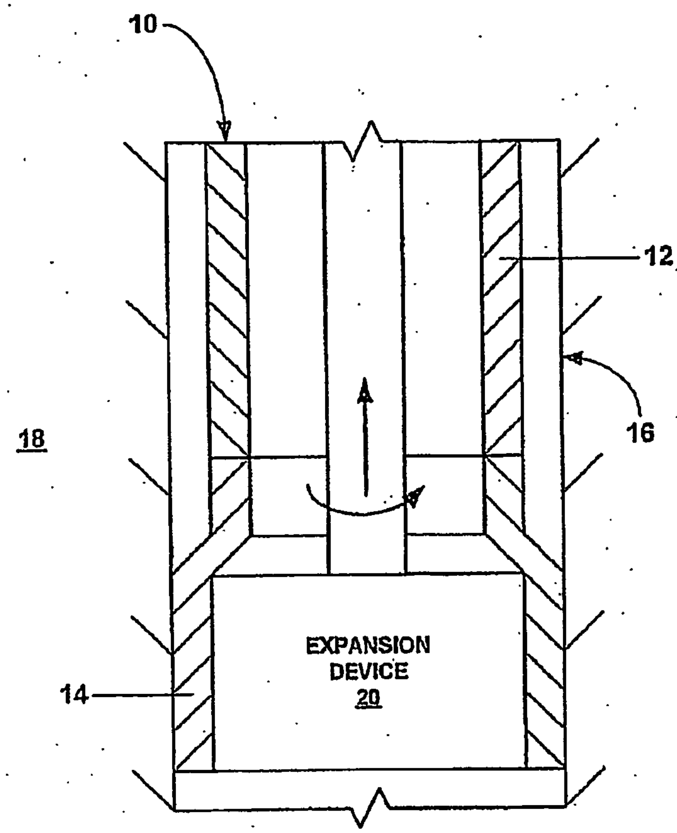


FIG. 3

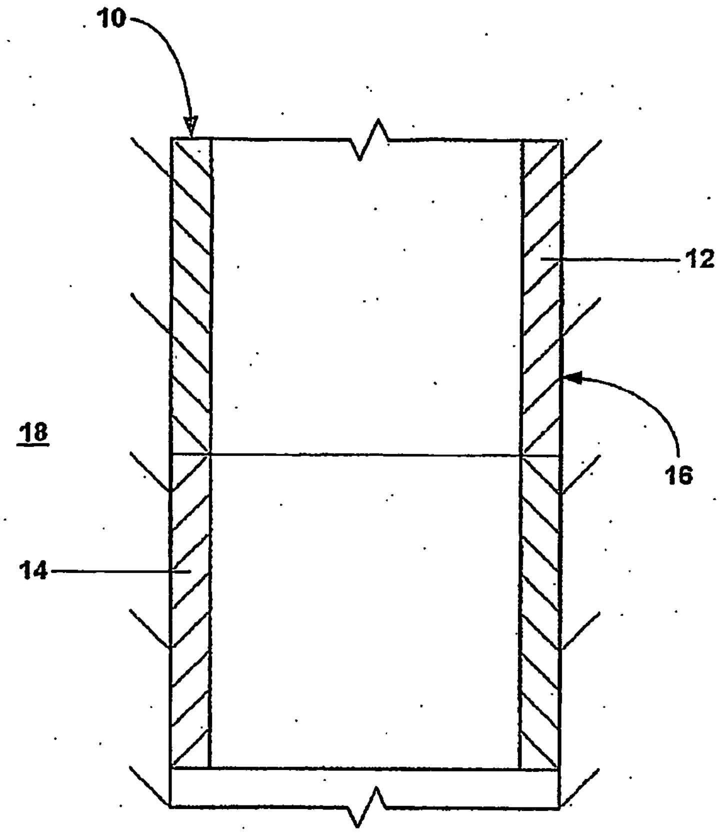
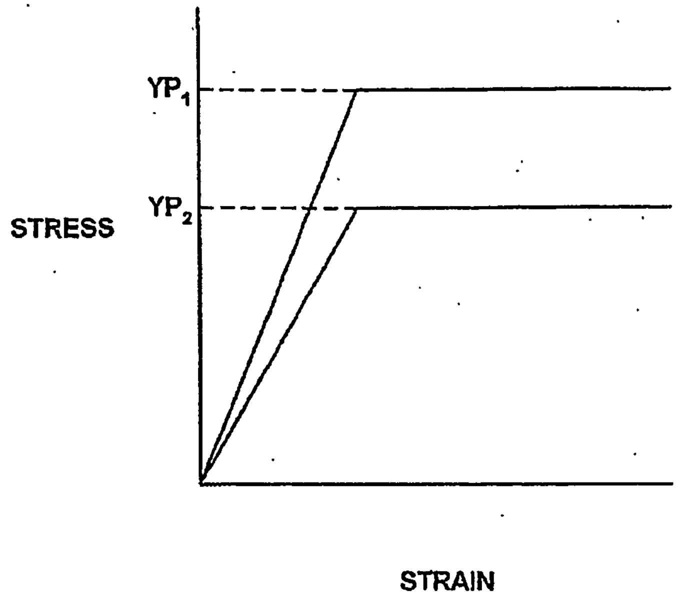
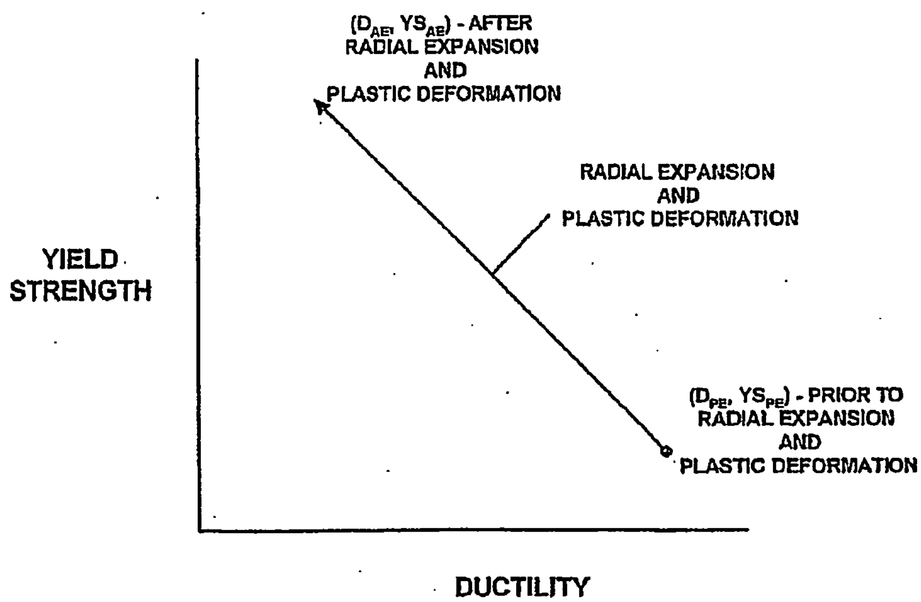


FIG. 4



STRESS
YP1
YP2
STRAIN

FIG. 5



(DAE, YSAE) - AFTER RADIAL EXPANSION AND PLASTIC DEFORMATION
RADIAL EXPANSION AND PLASTIC DEFORMATION
YIELD STRENGTH
(DPE, YSPE) - PRIOR TO RADIAL EXPANSION AND PLASTIC DEFORMATION
DUCTILITY

FIG. 6

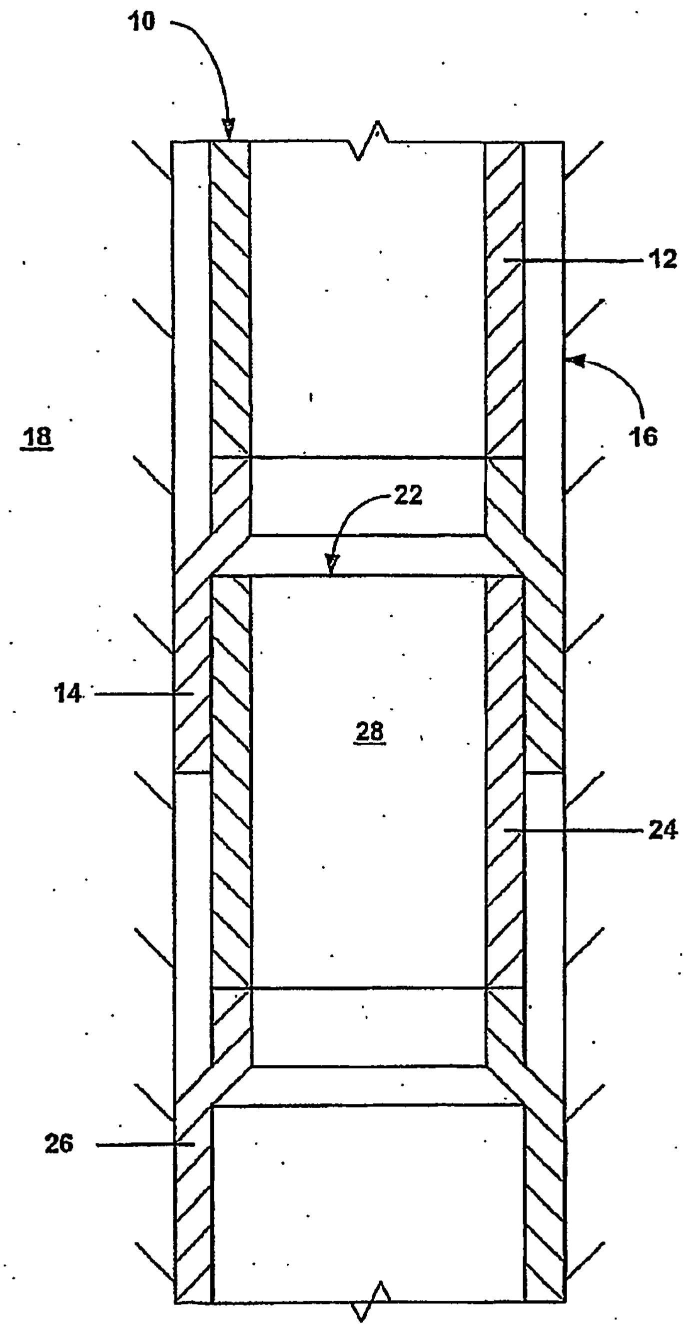


FIG. 7

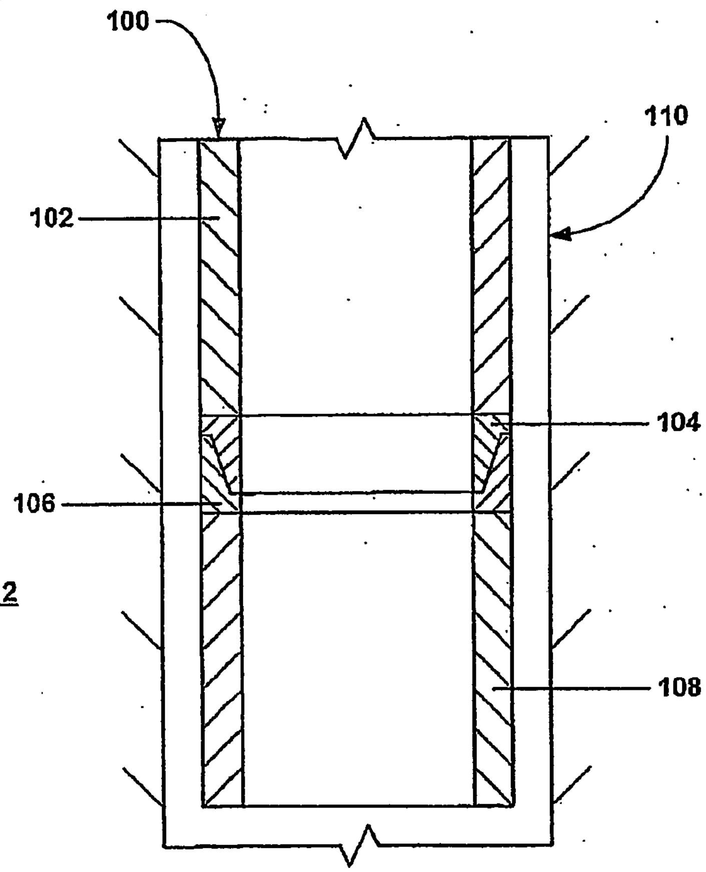


FIG. 8

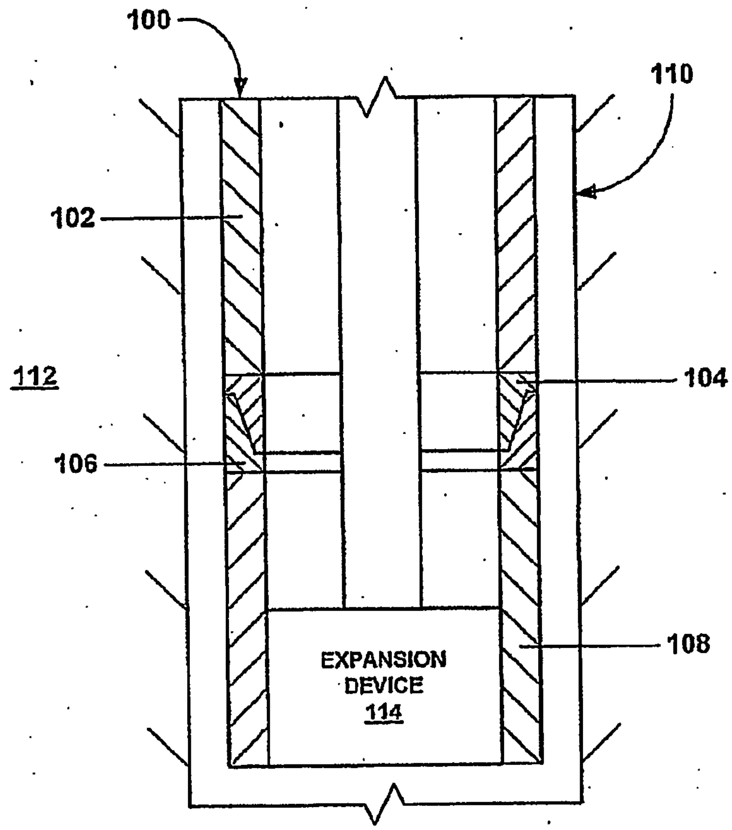


FIG. 9

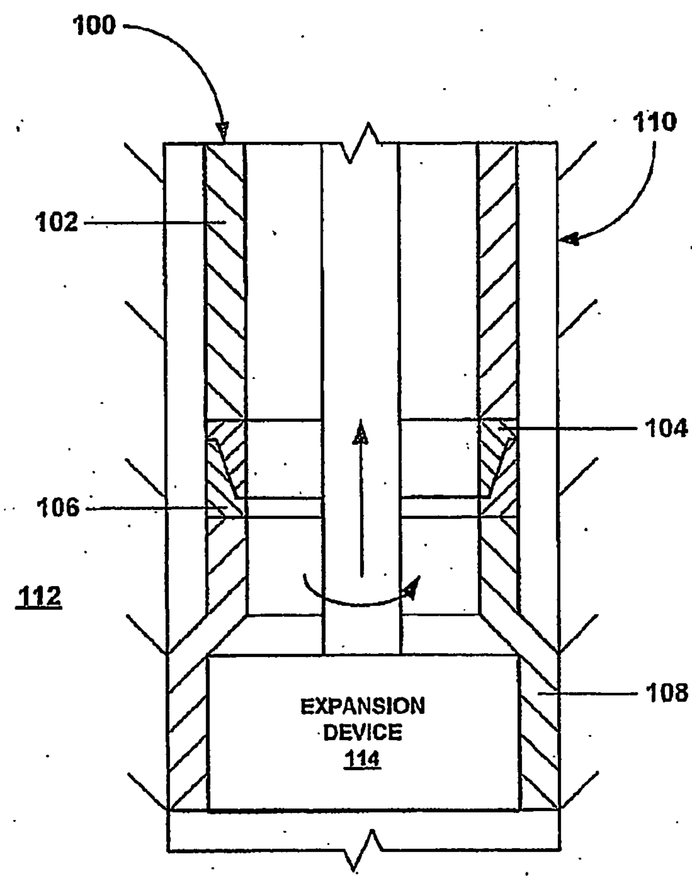


FIG. 10

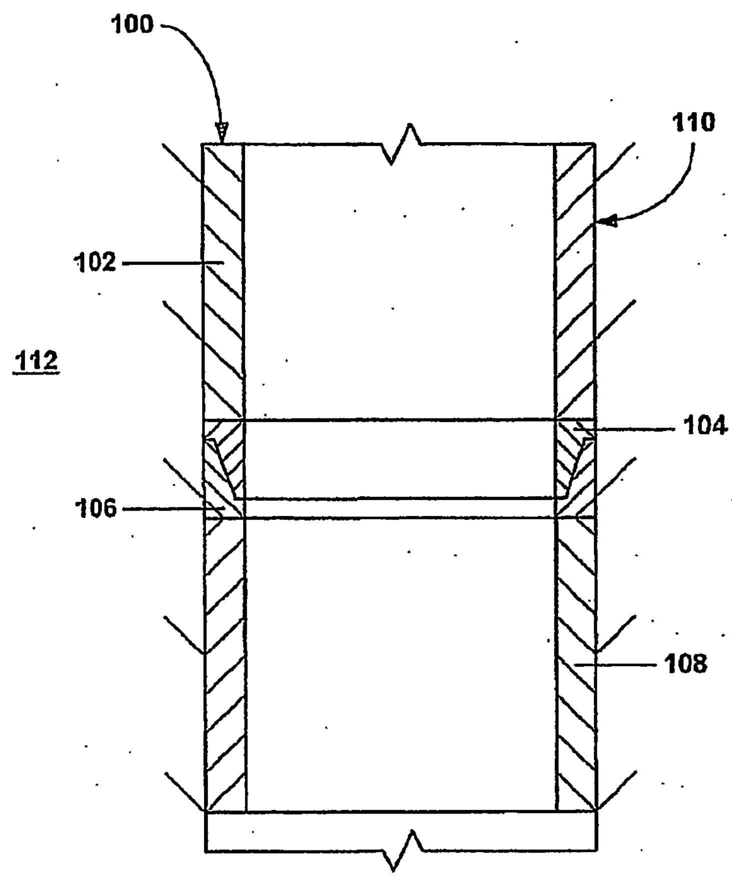


FIG. 11

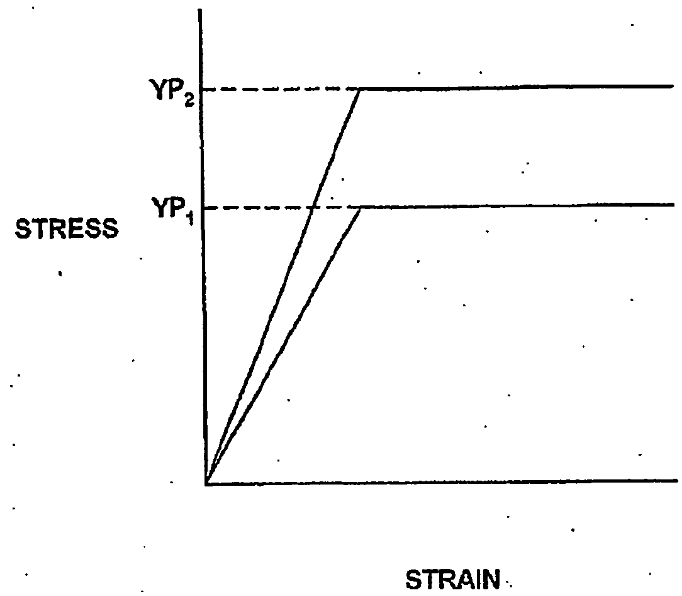

YP2
YP1
STRESS
STRAIN

FIG. 12

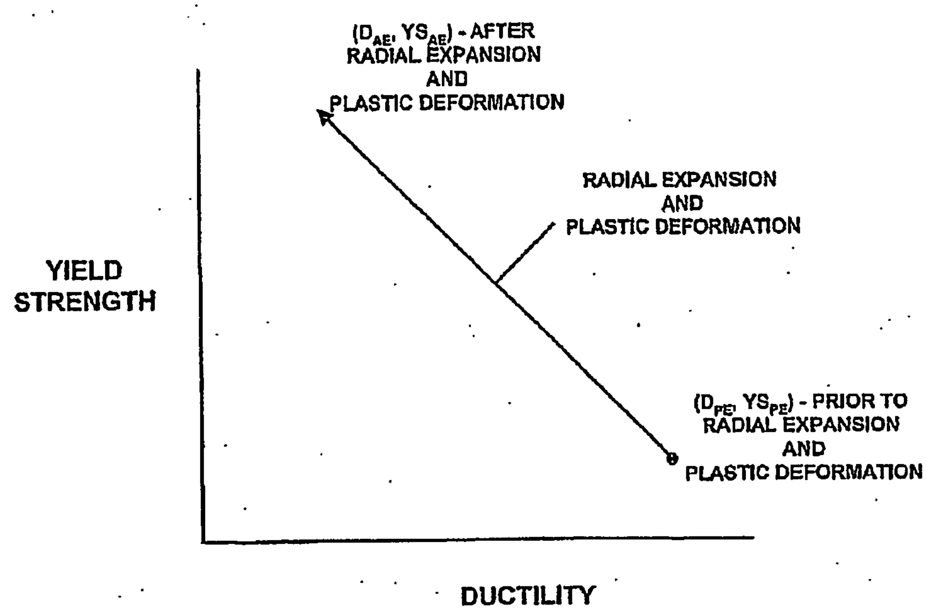

(DAE, YSAE) - AFTER RADIAL EXPANSION AND PLASTIC DEFORMATION
RADIAL EXPANSION AND PLASTIC DEFORMATION
YIELD STRENGTH
(DPE, YSPE) - PRIOR TO RADIAL EXPANSION AND PLASTIC DEFORMATION
DUCTILITY

FIG. 13

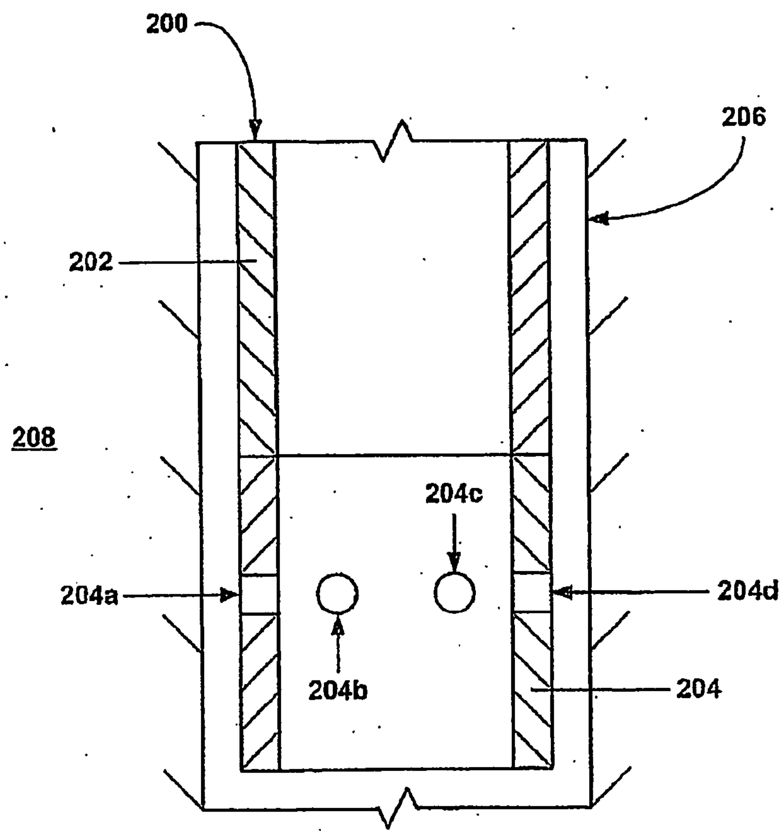


FIG. 14

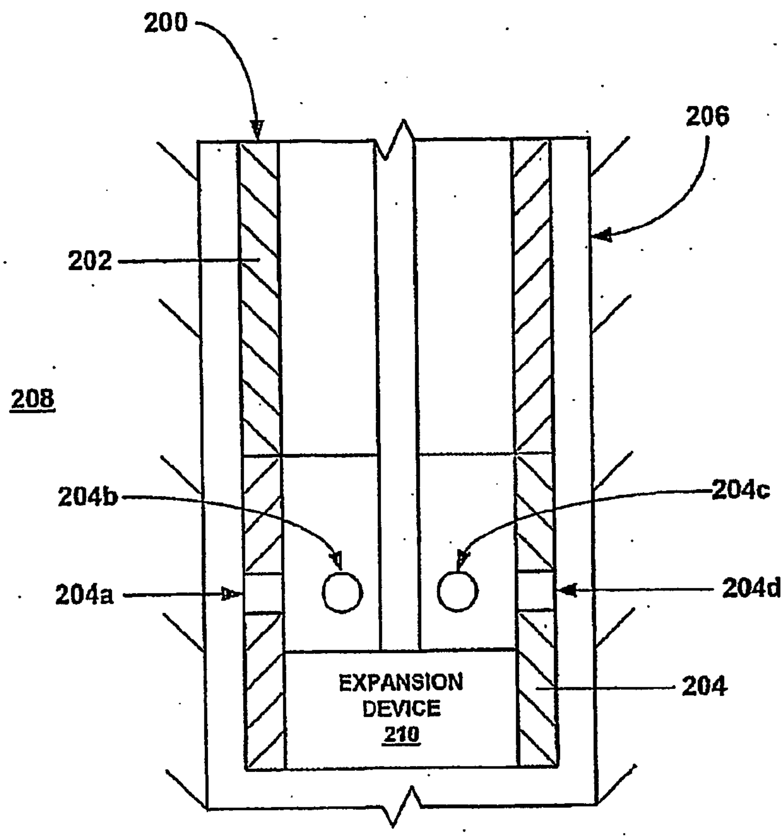


FIG. 15

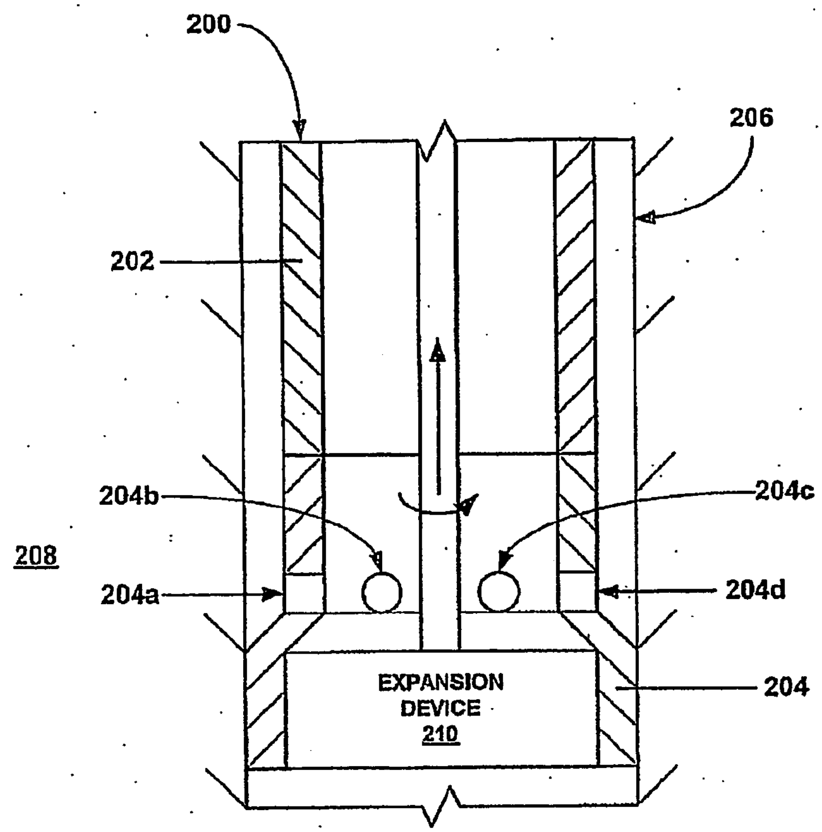


FIG. 16

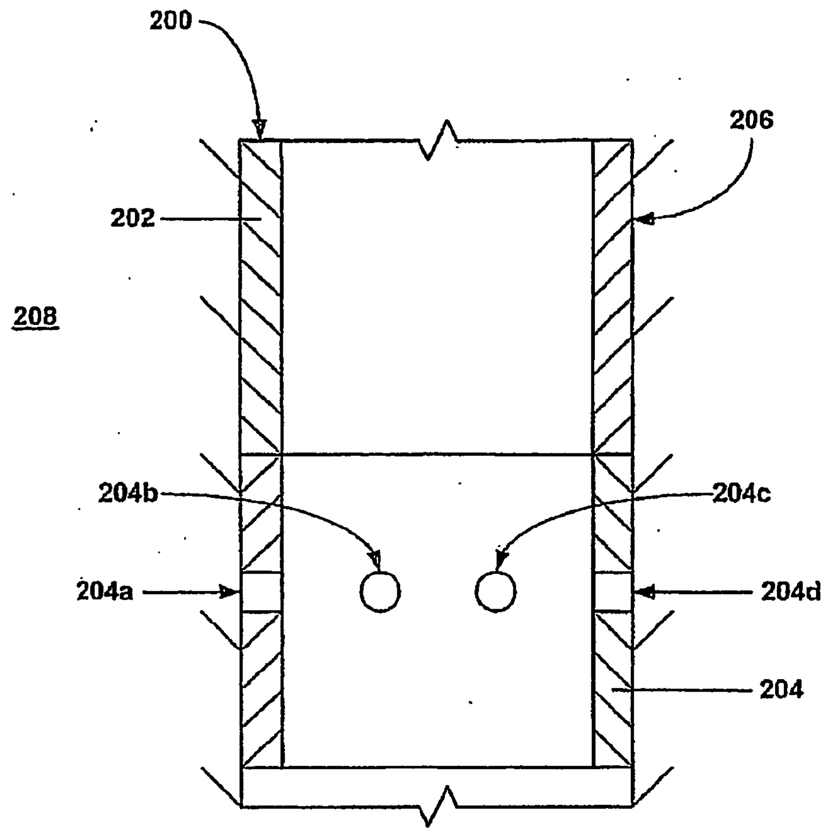


FIG. 17

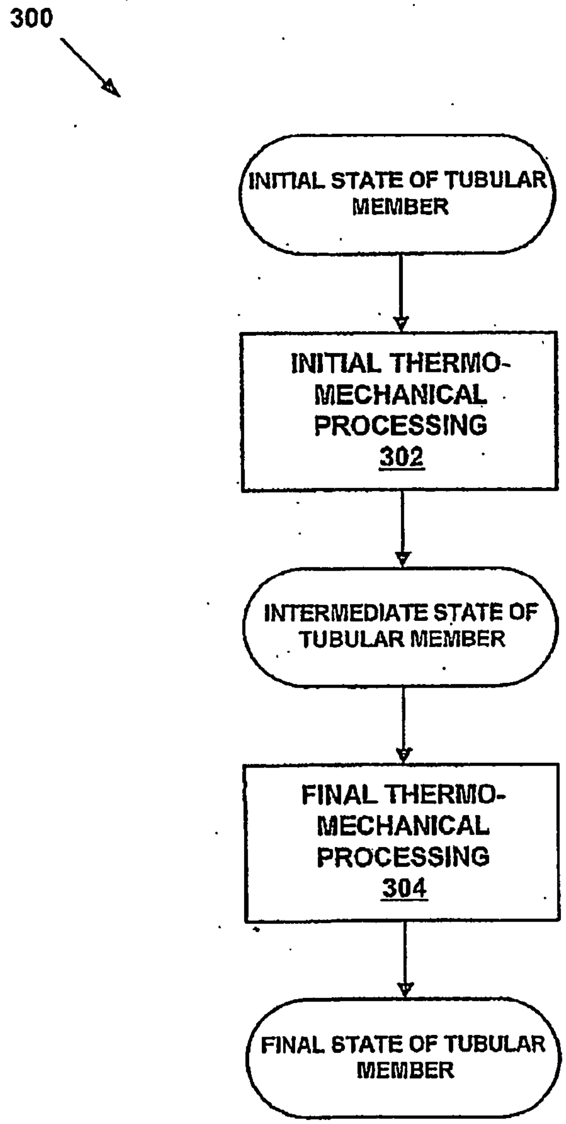

300
INITIAL STATE OF TUBULAR MEMBER
INITIAL THERMO-MECHANICAL PROCESSING
302
INTERMEDIATE STATE OF TUBULAR MEMBER
FINAL THERMO-MECHANICAL PROCESSING
304
FINAL STATE OF TUBULAR MEMBER

Fig. 18

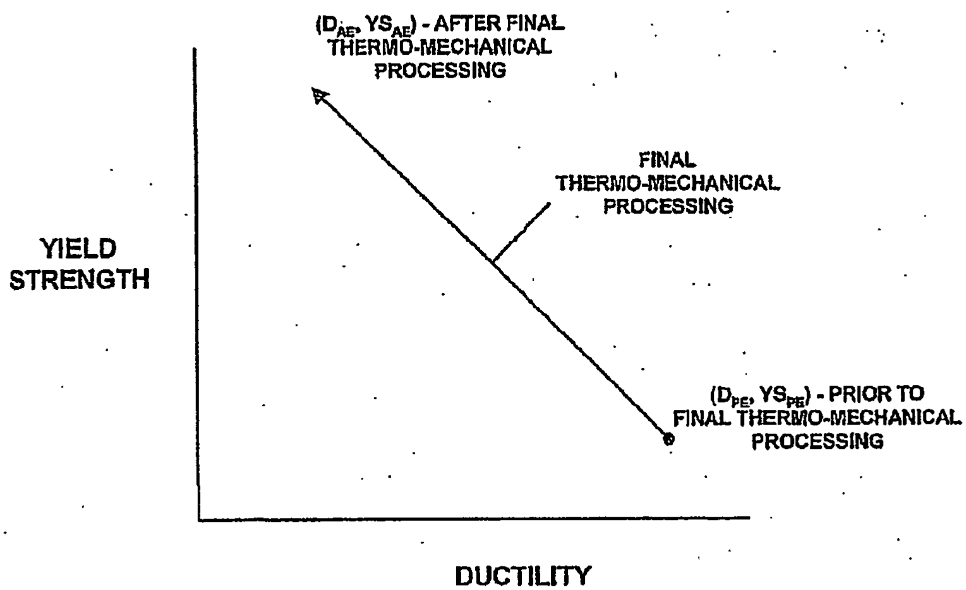

(D_{AE}, YS_{AE}) - AFTER FINAL THERMO-MECHANICAL PROCESSING
FINAL THERMO-MECHANICAL PROCESSING
YIELD STRENGTH
(D_{PE}, YS_{PE}) - PRIOR TO FINAL THERMO-MECHANICAL PROCESSING
DUCTILITY

FIG. 19

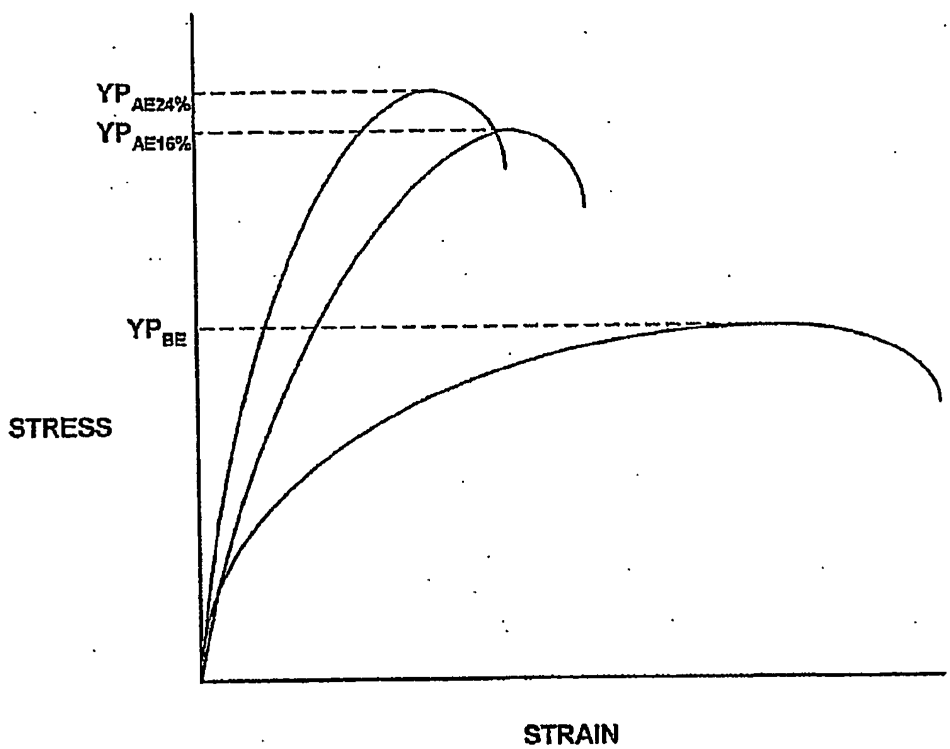


FIG. 20

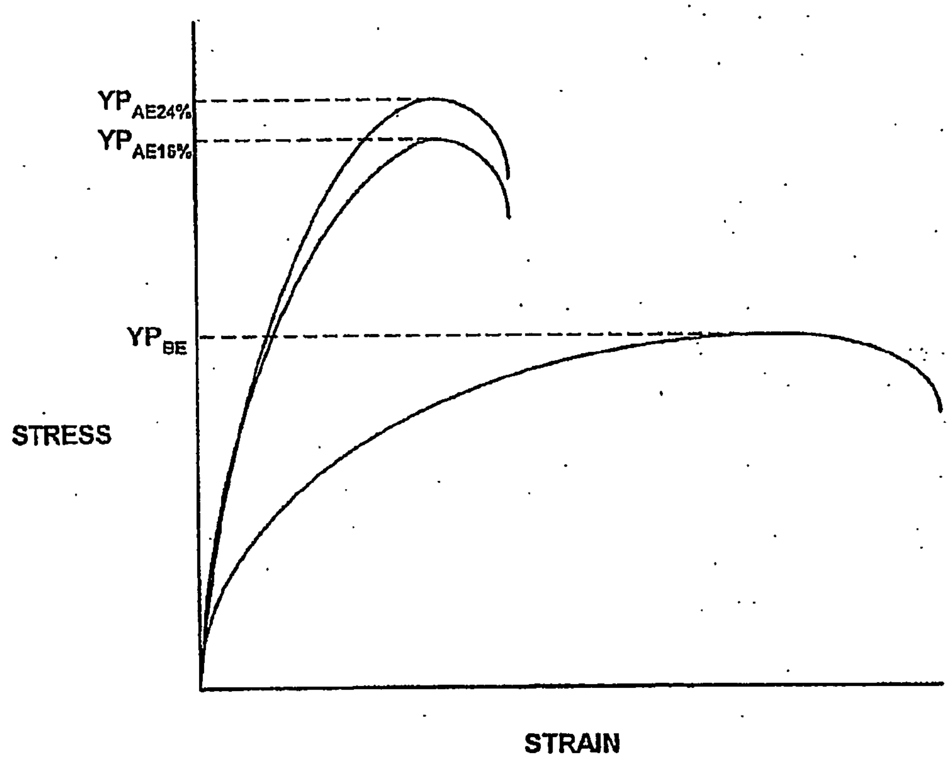


FIG. 21

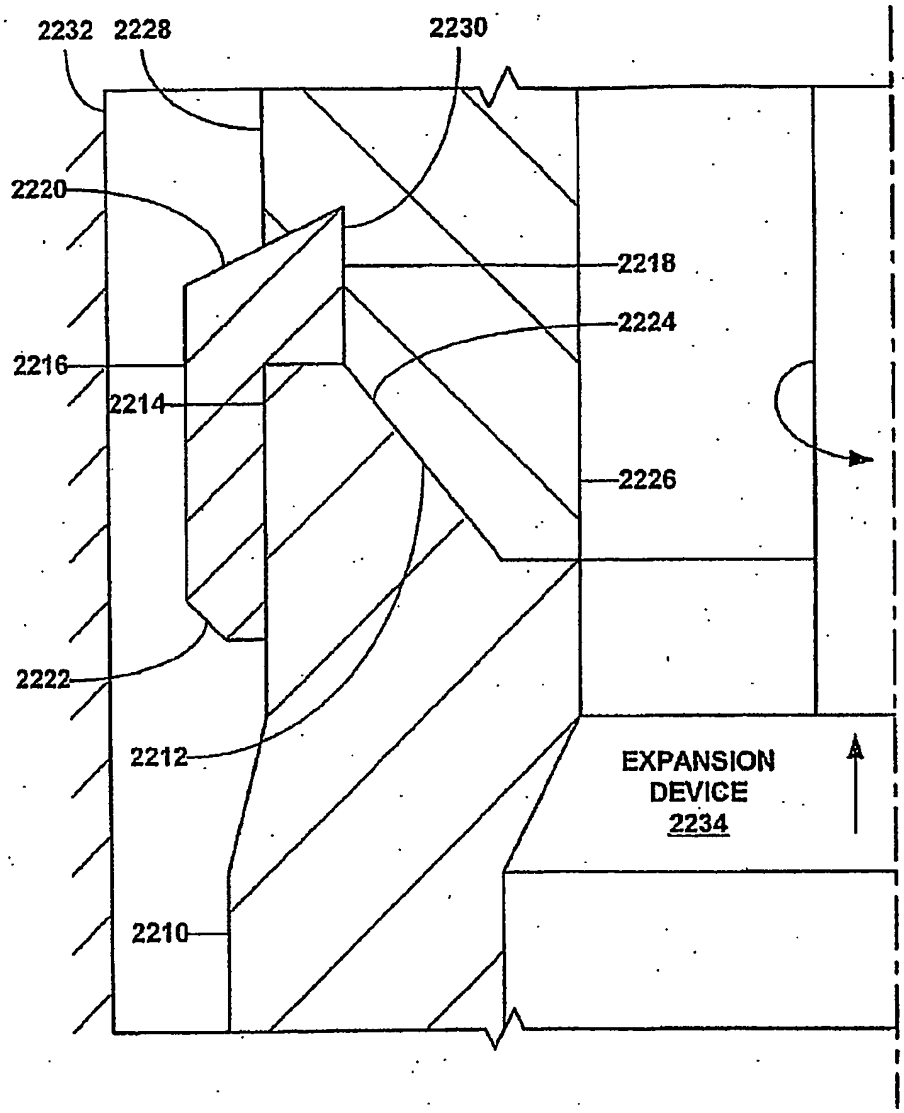

2232
2228
2230
2220
2218
2224
2216
2214
2226
2222
2212
EXPANSION
DEVICE
2234
2210

FIG. 22

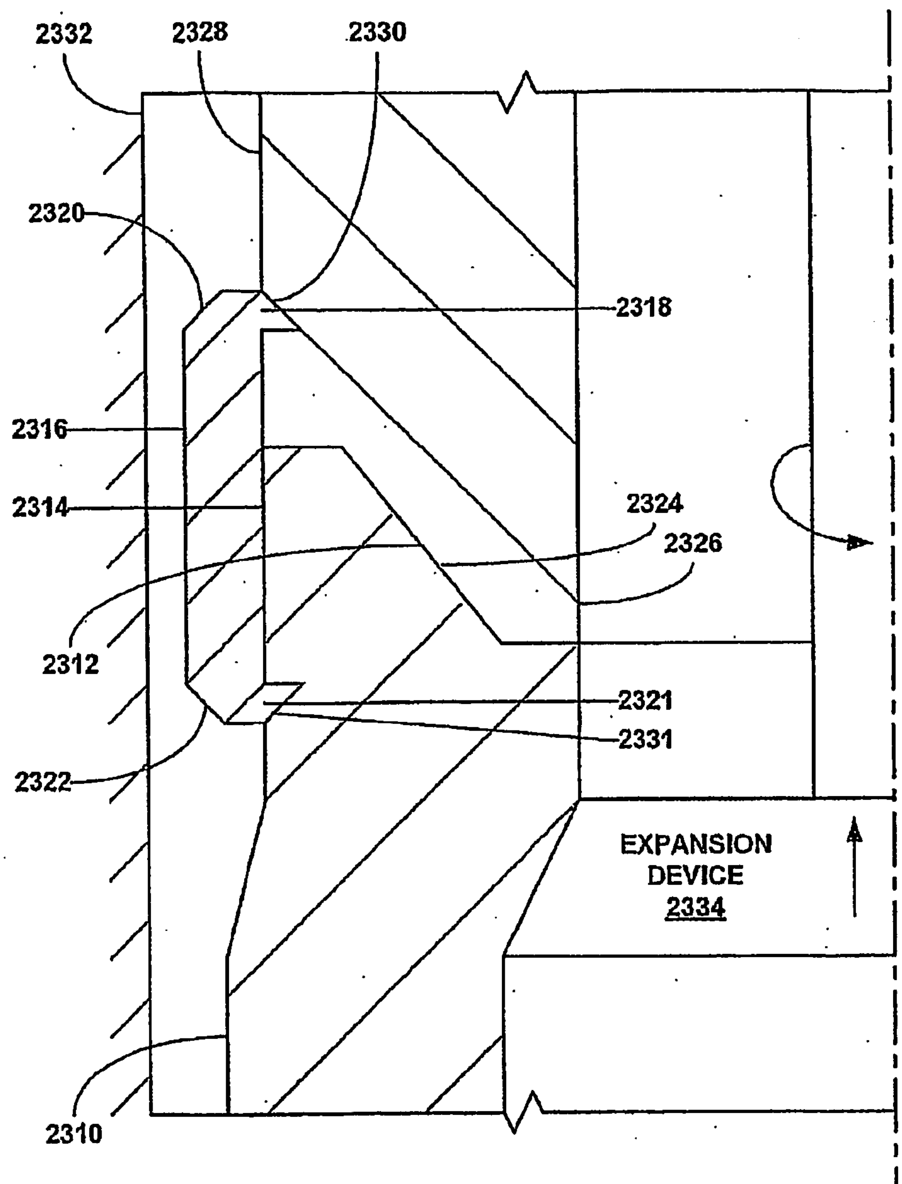

2332
2328
2330
2320
2318
2316
2314
2324
2326
2312
2321
2331
2322
EXPANSION DEVICE 2334
2310

FIG. 23

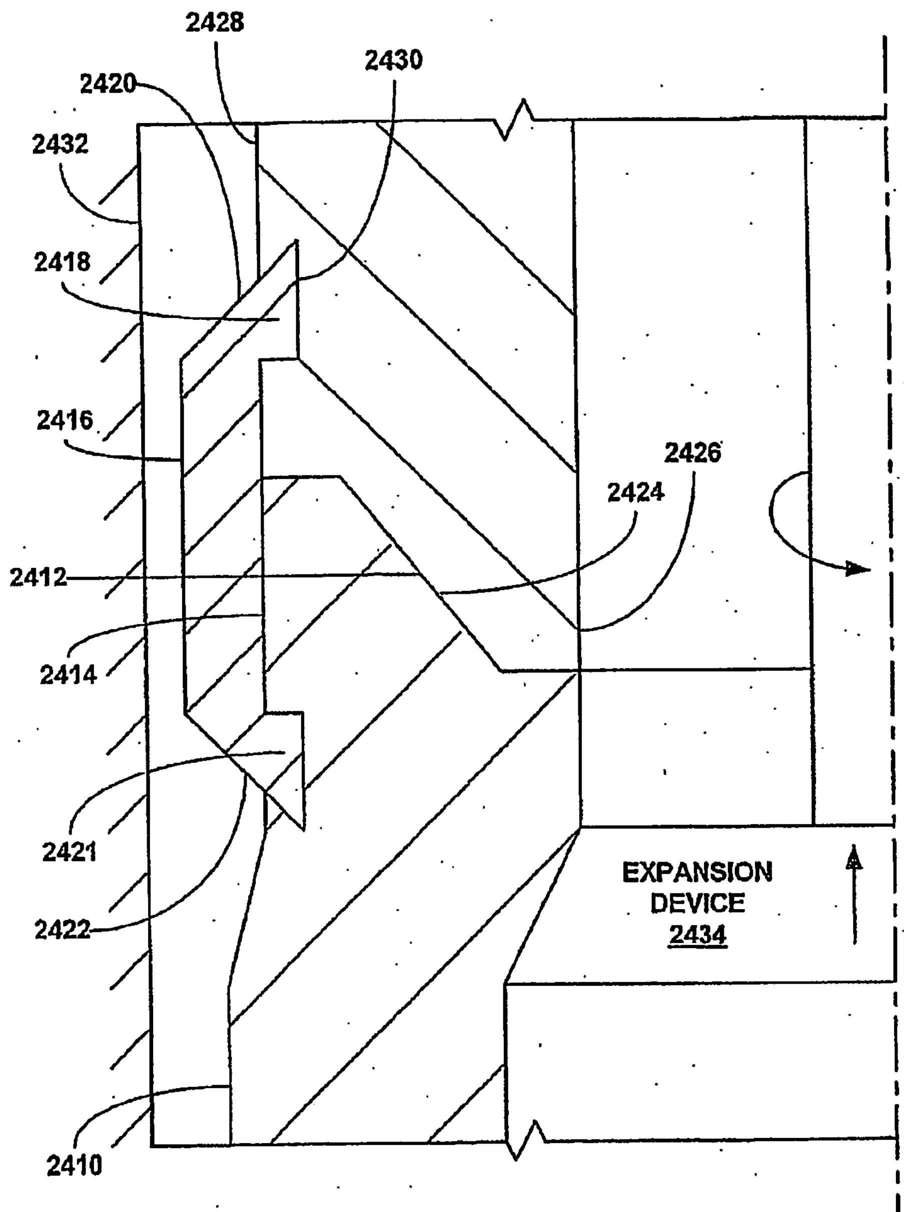

2428
2430
2420
2432
2418
2416
2426
2424
2412
2414
2421
2422
EXPANSION
DEVICE
2434
2410

FIG. 24

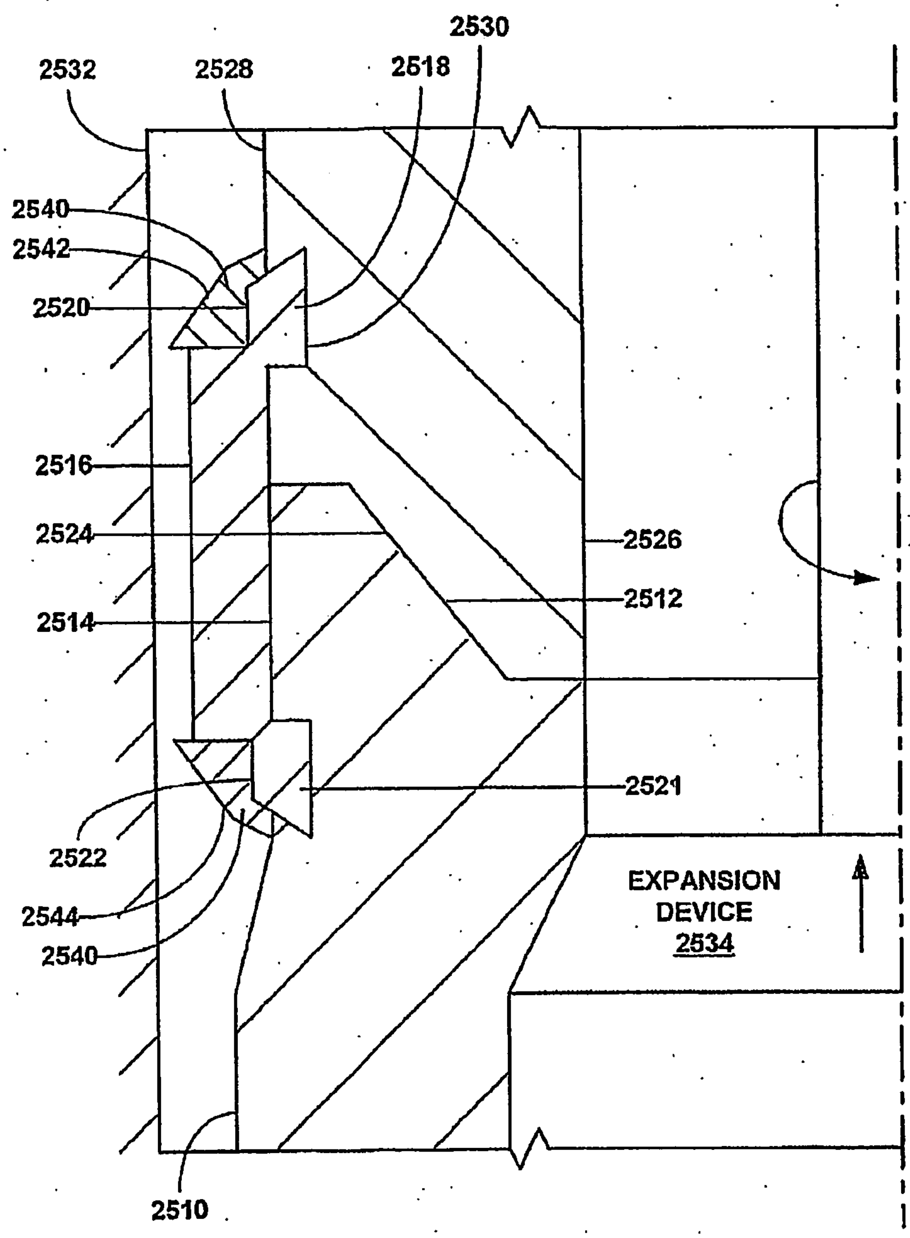

2530
2532
2528
2518
2540
2542
2520
2516
2524
2526
2512
2514
2521
2522
2544
2540
EXPANSION
DEVICE
2534
2510

FIG. 25

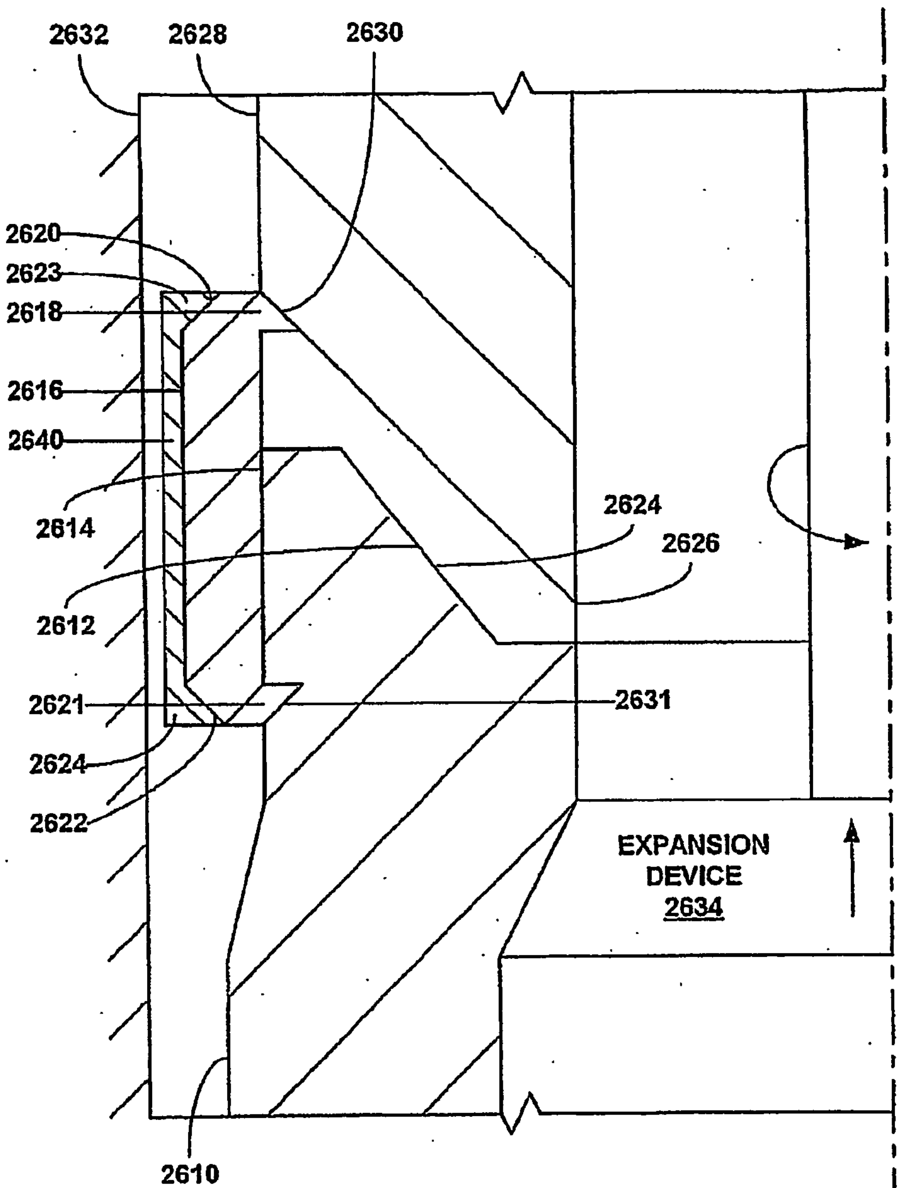

2632
2628
2630
2620
2623
2618
2616
2640
2614
2624
2626
2612
2621
2631
2624
2622
EXPANSION
DEVICE
2634
2610

FIG. 26

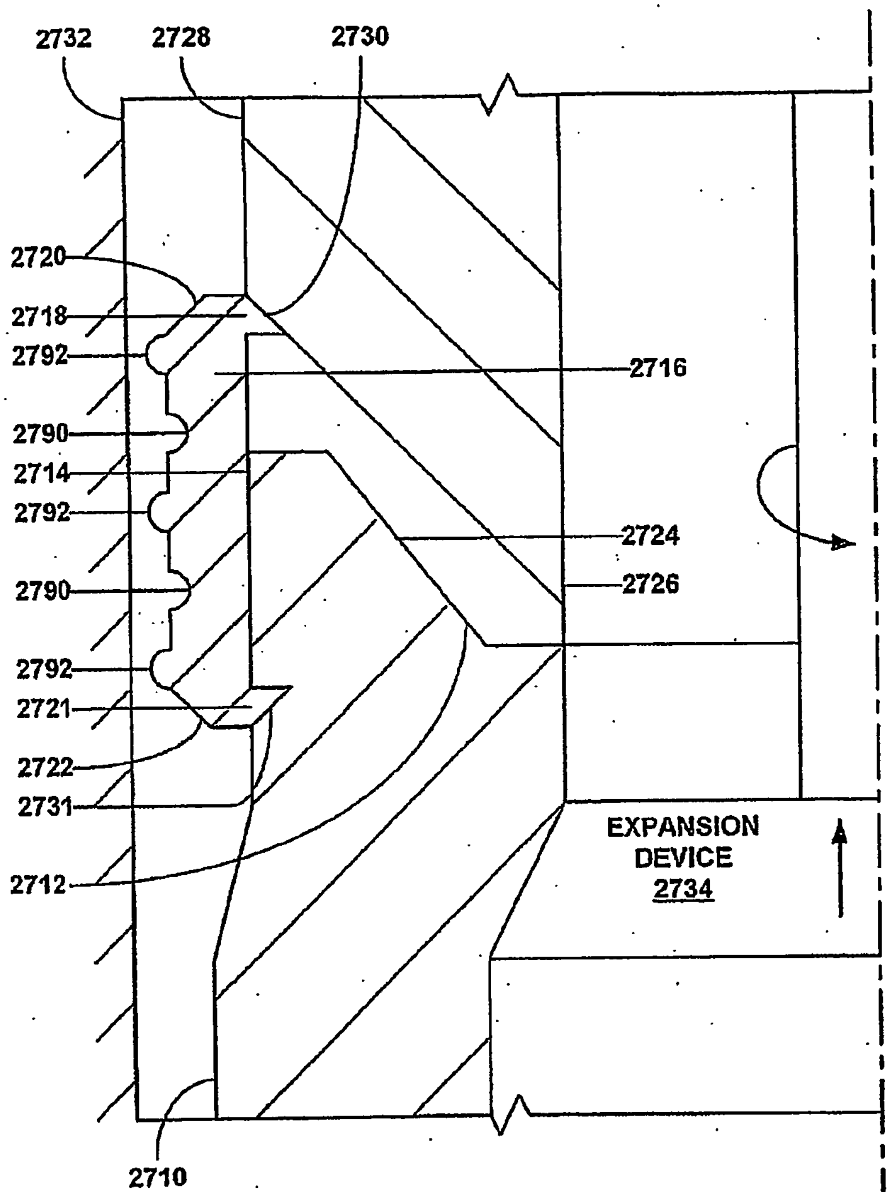

2732
2728
2730
2720
2718
2792
2716
2790
2714
2792
2724
2726
2790
2792
2721
2722
2731
2712
EXPANSION DEVICE 2734
2710

FIG. 27

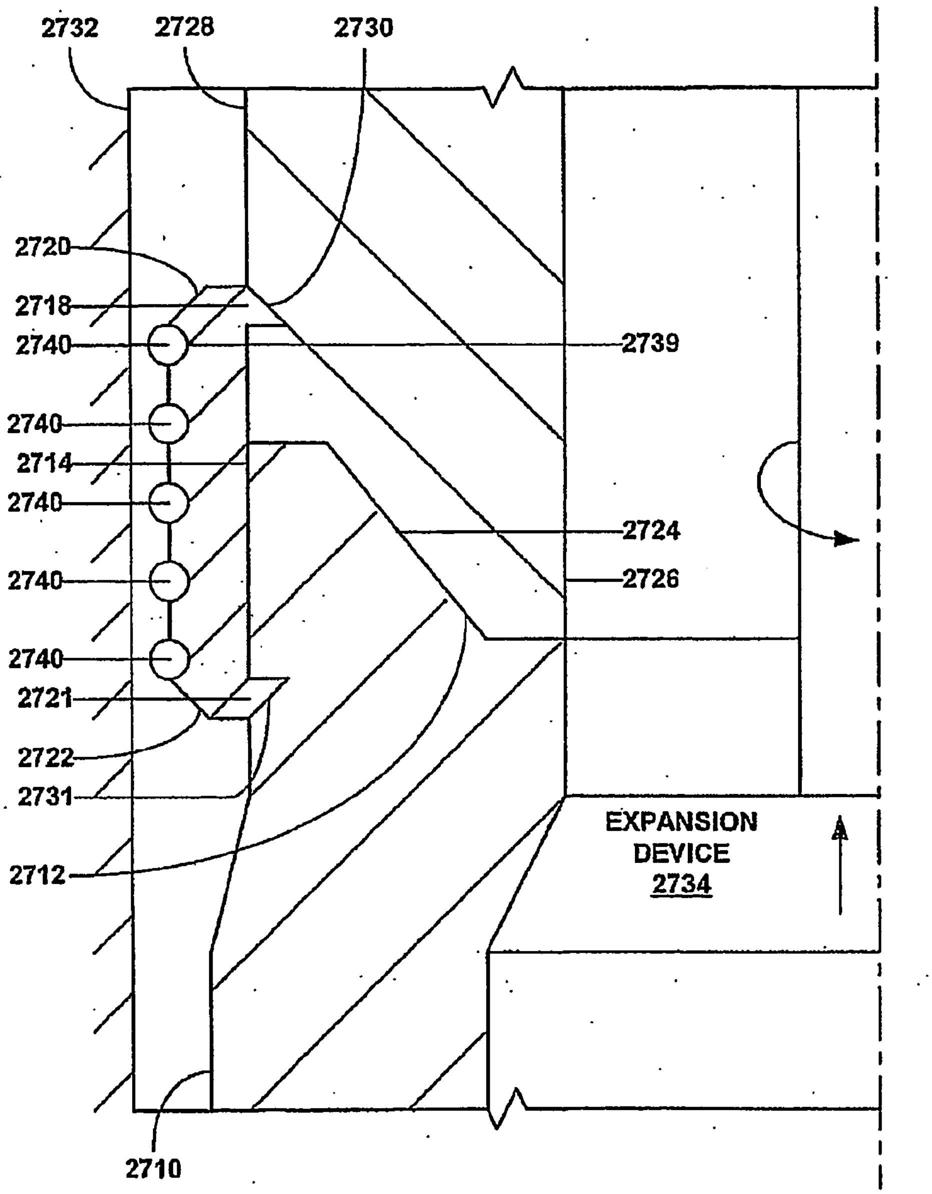

2732
2728
2730
2720
2718
2740
2739
2740
2714
2740
2724
2740
2726
2740
2721
2722
2731
2712
EXPANSION
DEVICE
2734
2710

FIG. 28

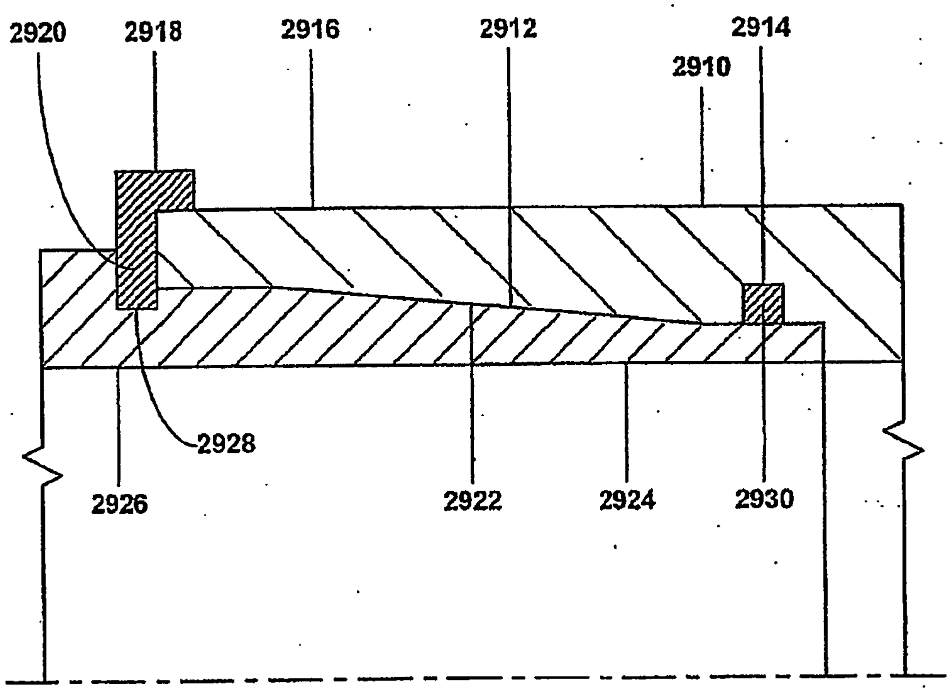


FIG. 29

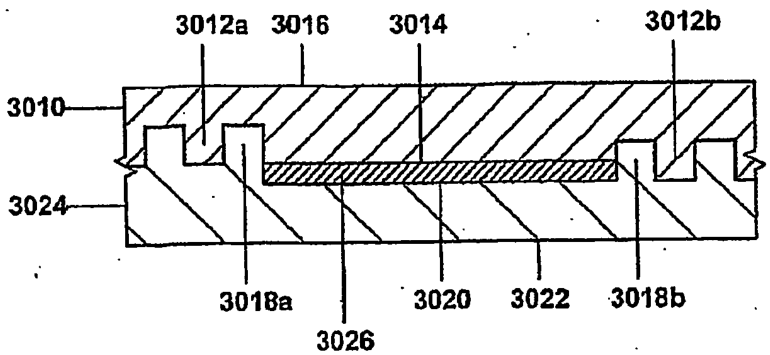


FIG. 30a

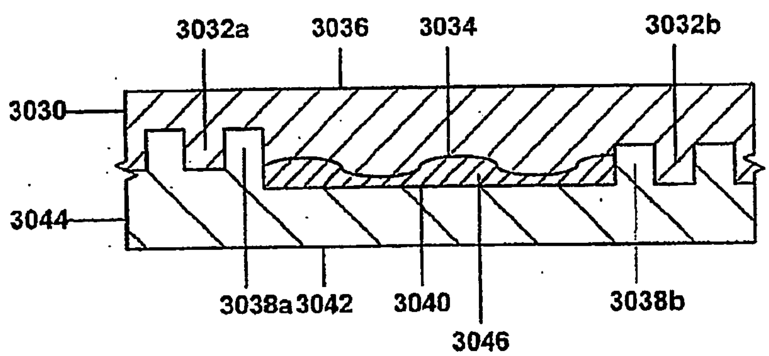


FIG. 30b

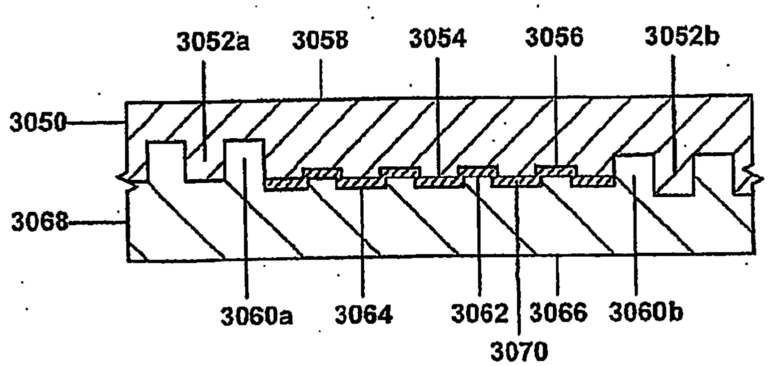


FIG. 30c

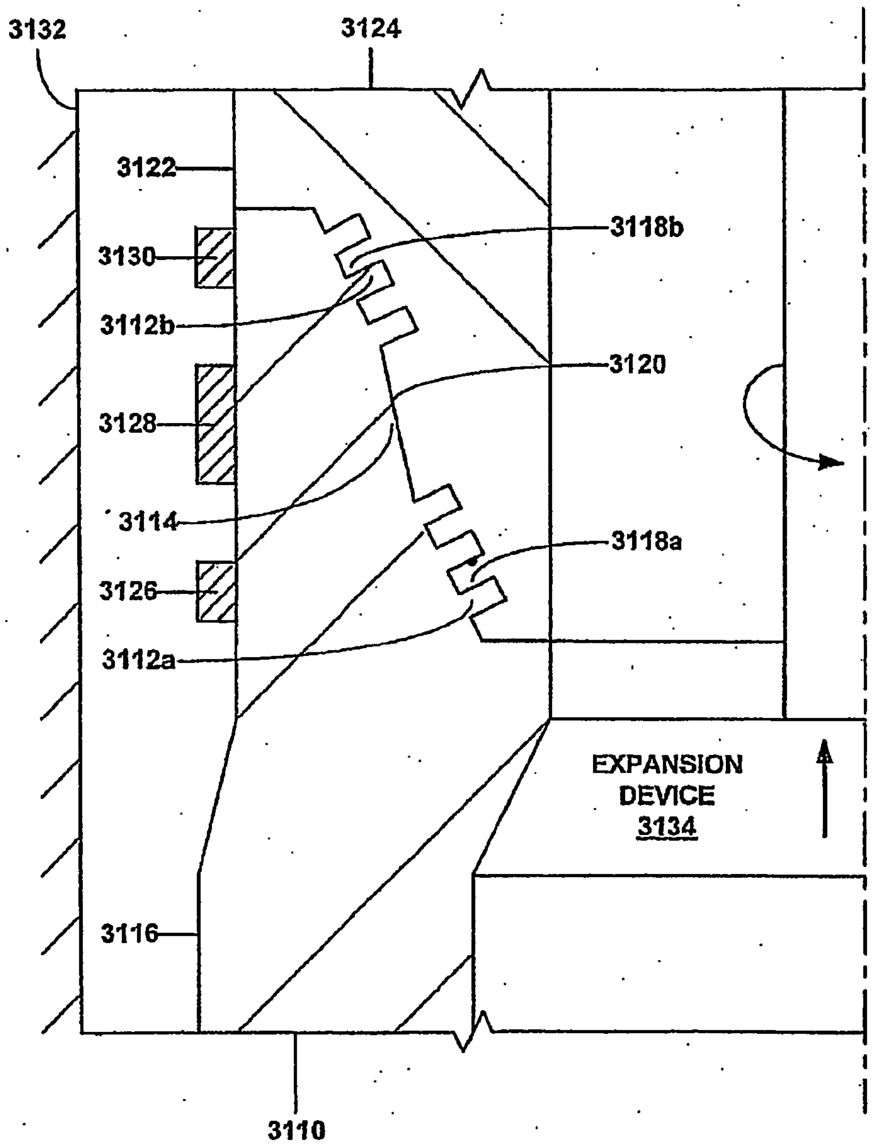

3132
3124
3122
3118b
3130
3112b
3120
3128
3114
3118a
3126
3112a
EXPANSION DEVICE 3134
3116
3110

FIG. 31

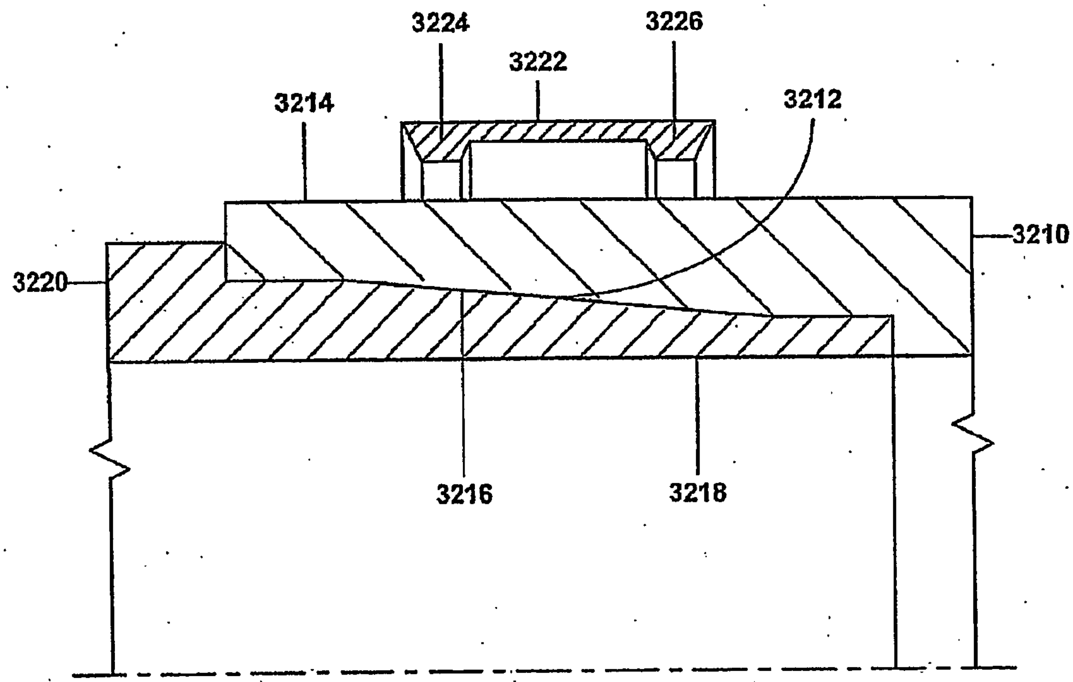


FIG. 32a

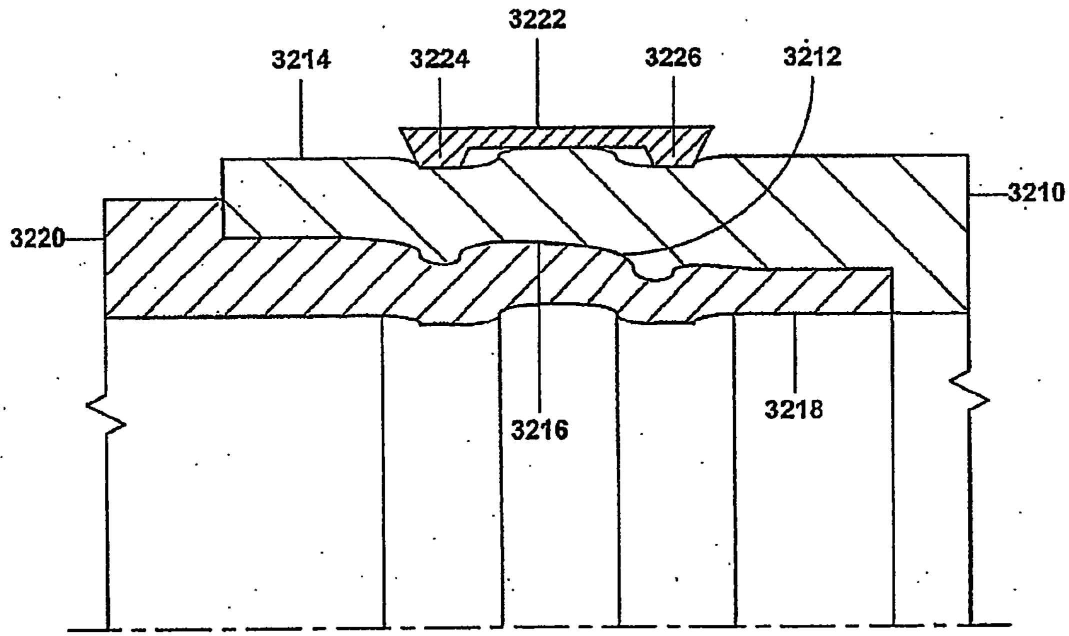


FIG. 32b

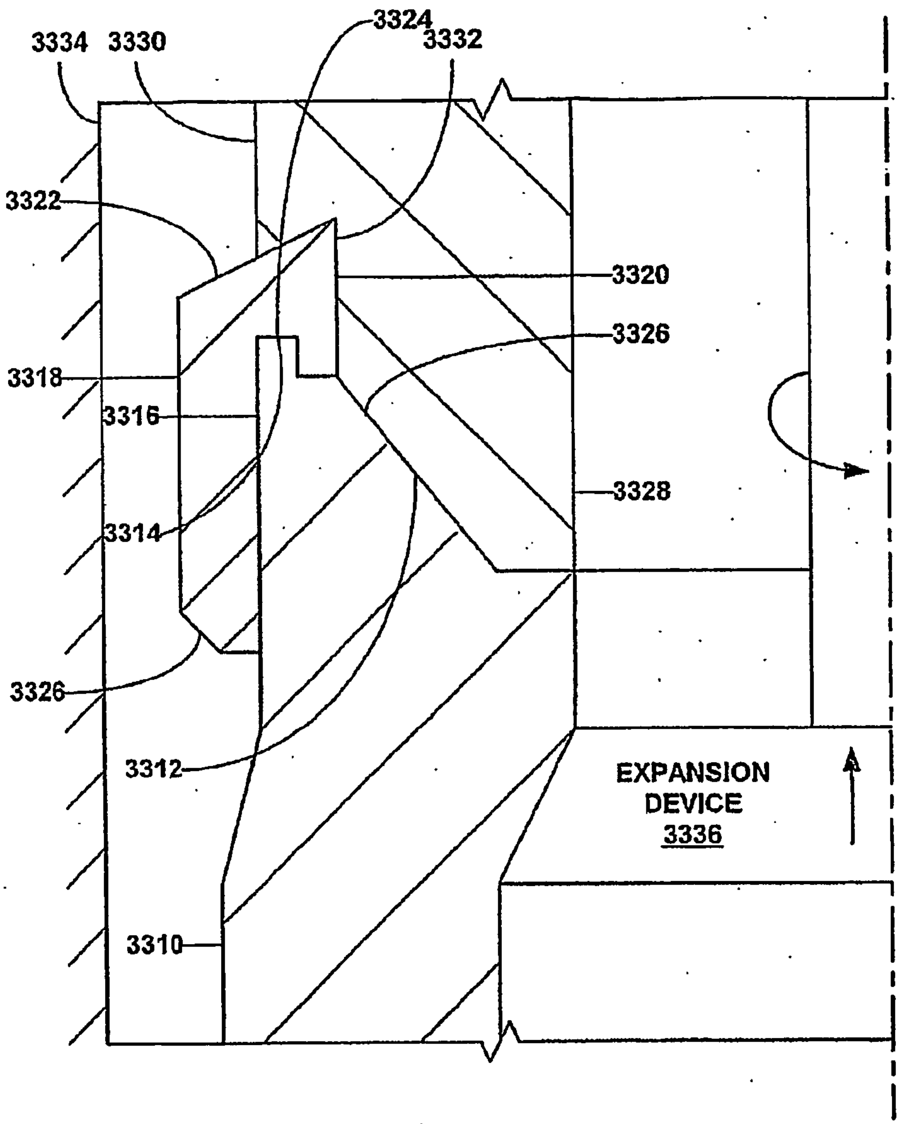

3334
3330
3324
3332
3322
3320
3326
3318
3316
3328
3314
3326
3312
EXPANSION
DEVICE
3336
3310

FIG. 33

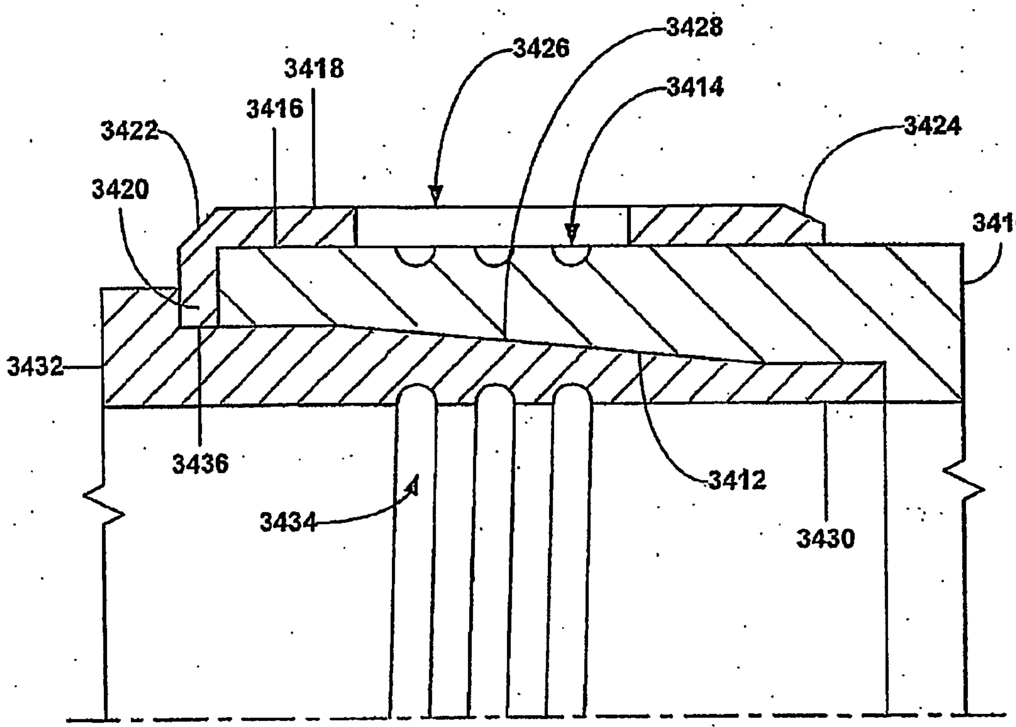

3428
3426
3418
3414
3416
3422
3424
3420
3410
3432
3436
3412
3434
3430

FIG. 34a

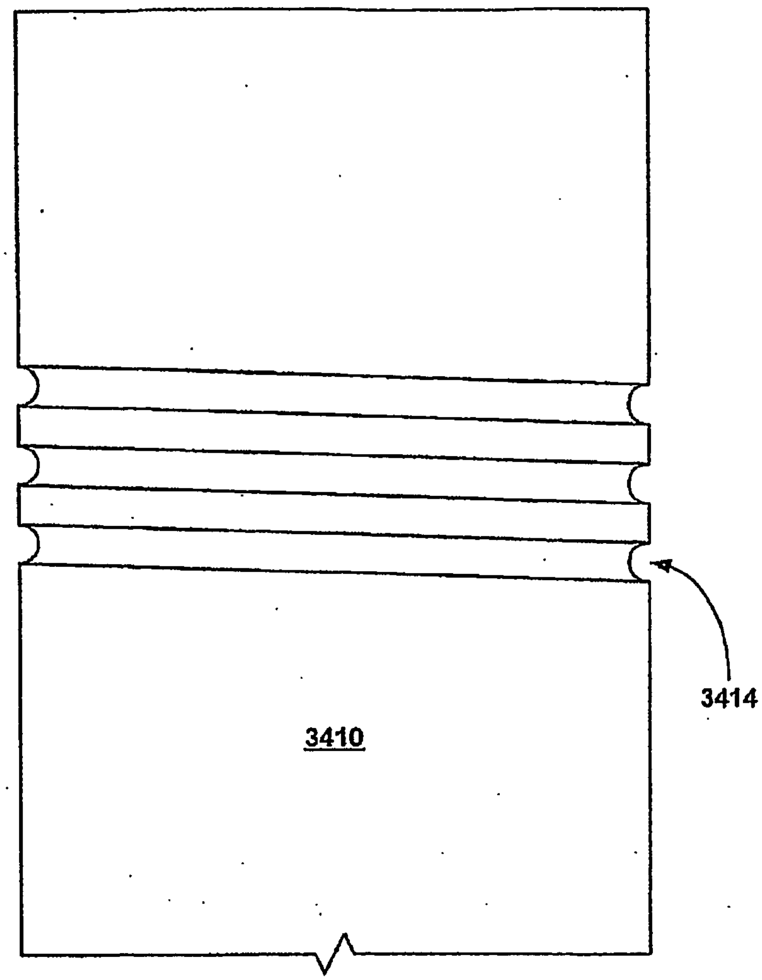


Fig. 34b

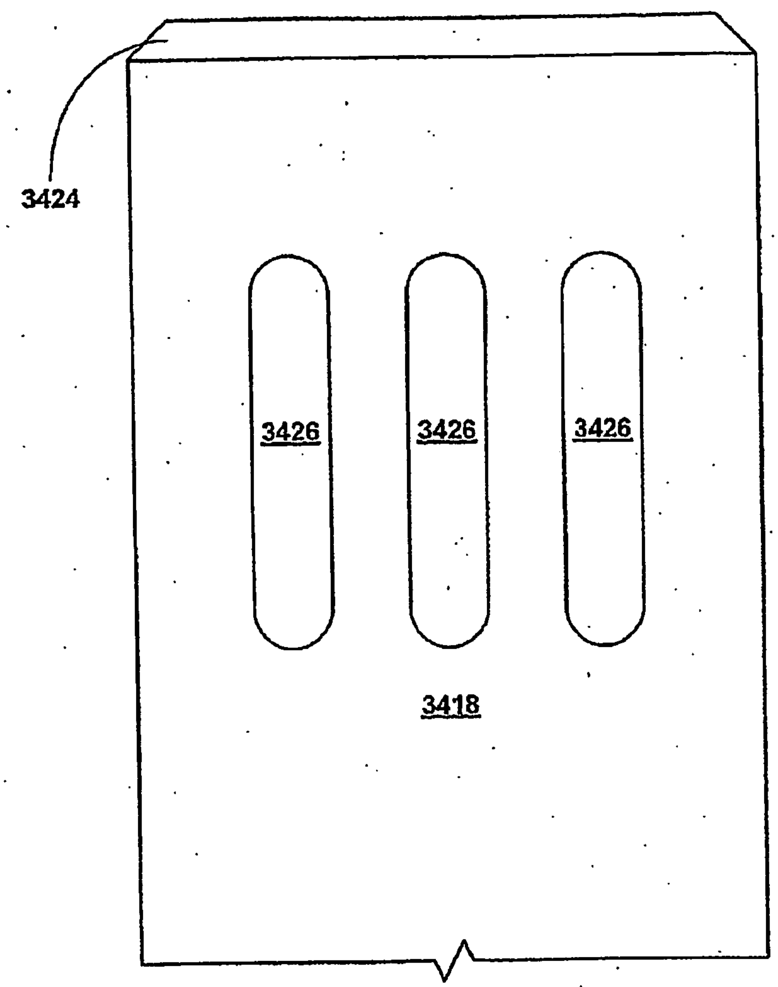


Fig. 34c

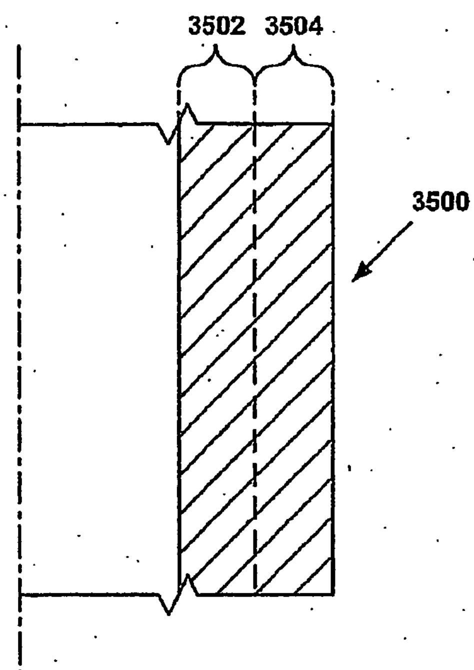


FIG. 35a

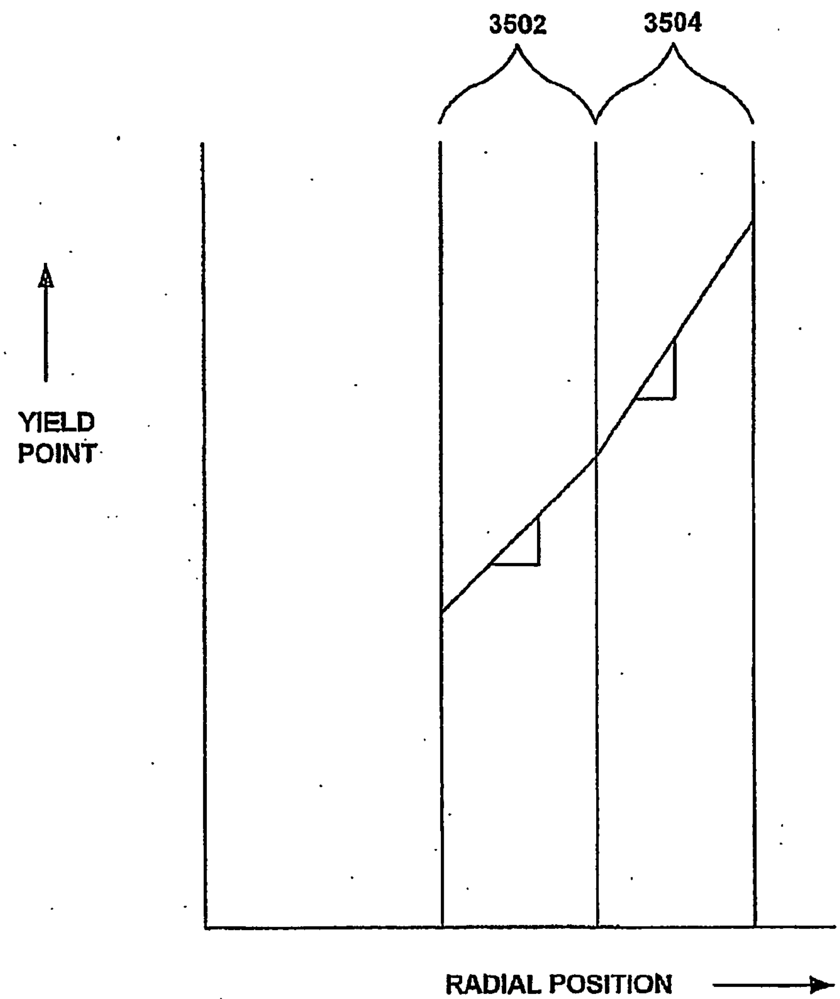


FIG. 35b

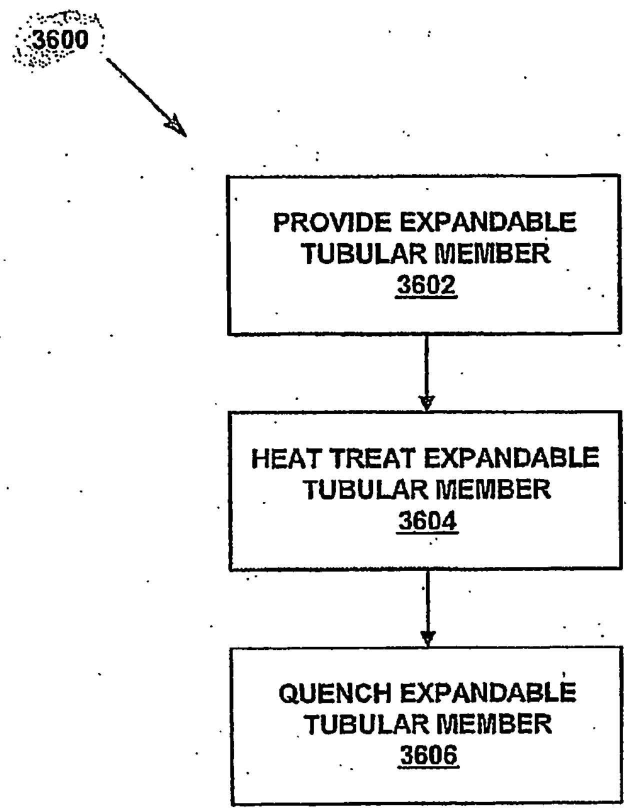

3600
PROVIDE EXPANDABLE TUBULAR MEMBER
3602
HEAT TREAT EXPANDABLE TUBULAR MEMBER
3604
QUENCH EXPANDABLE TUBULAR MEMBER
3606

FIG. 36a

3602a

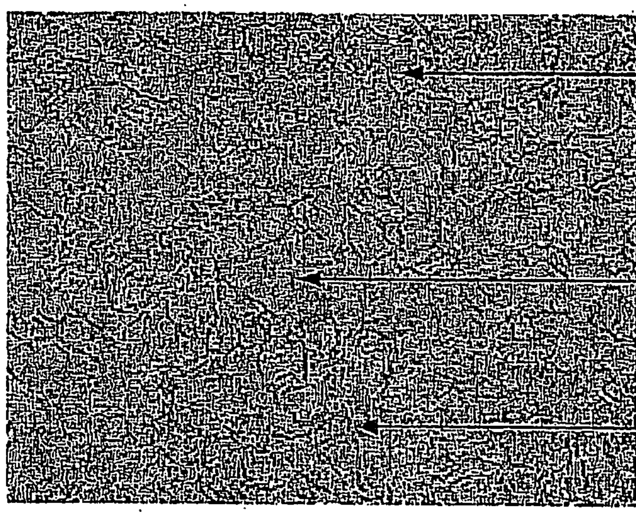


Fig. 36b

3602a

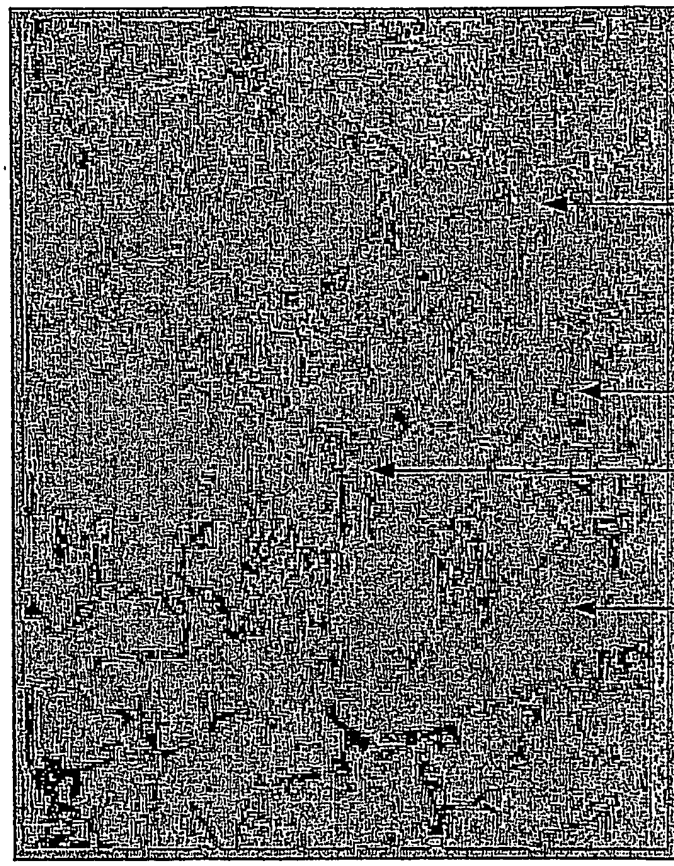


Fig. 36c

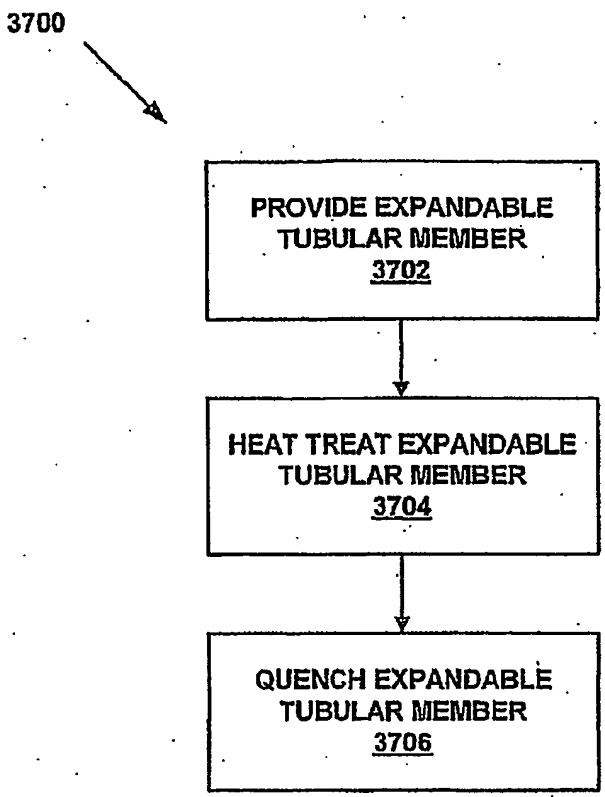

3700
PROVIDE EXPANDABLE TUBULAR MEMBER
3702
HEAT TREAT EXPANDABLE TUBULAR MEMBER
3704
QUENCH EXPANDABLE TUBULAR MEMBER
3706

FIG. 37a

3702a

Fig. 37b

3702a

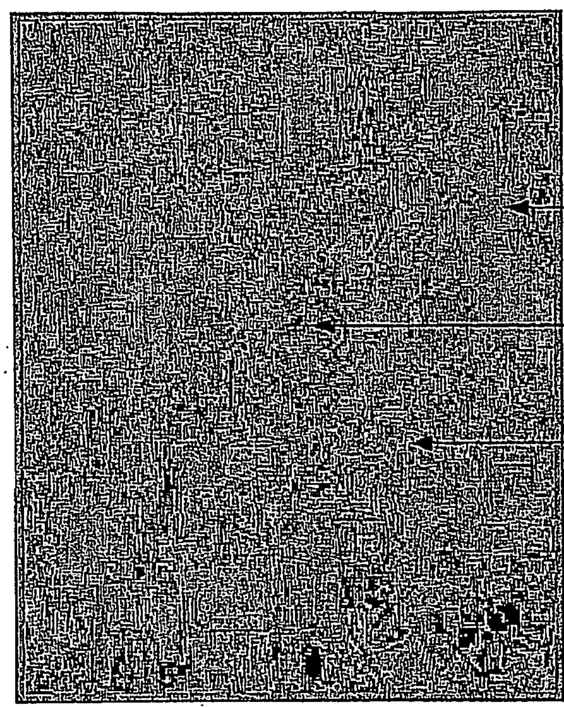


Fig. 37c

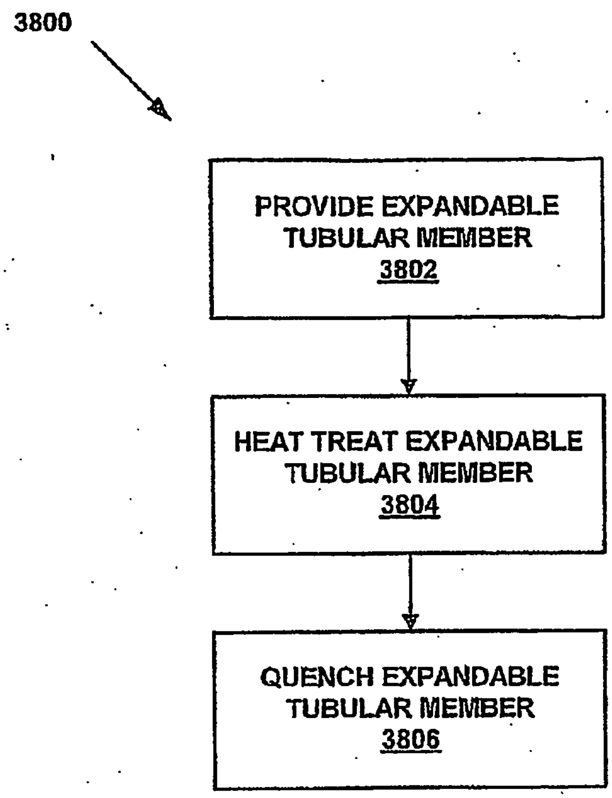

3800
PROVIDE EXPANDABLE TUBULAR MEMBER
3802
HEAT TREAT EXPANDABLE TUBULAR MEMBER
3804
QUENCH EXPANDABLE TUBULAR MEMBER
3806

FIG. 38a

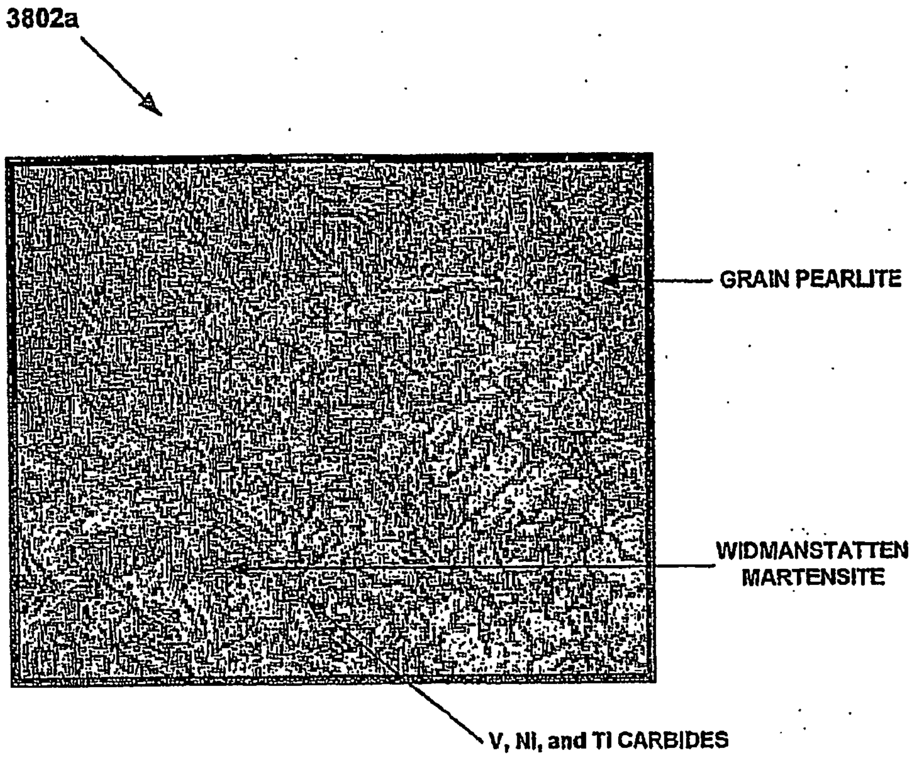

3802a
GRAIN PEARLITE
WIDMANSTATTEN
MARTENSITE
V, Ni, and Ti CARBIDES

Fig. 38b

3802a

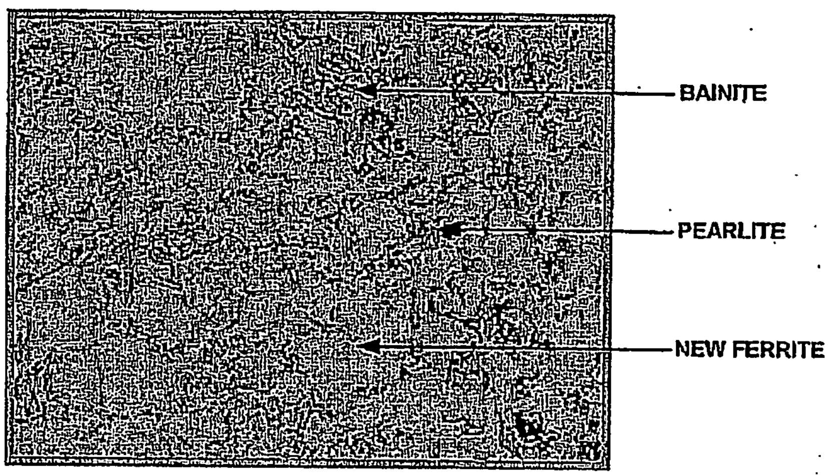


Fig. 38c

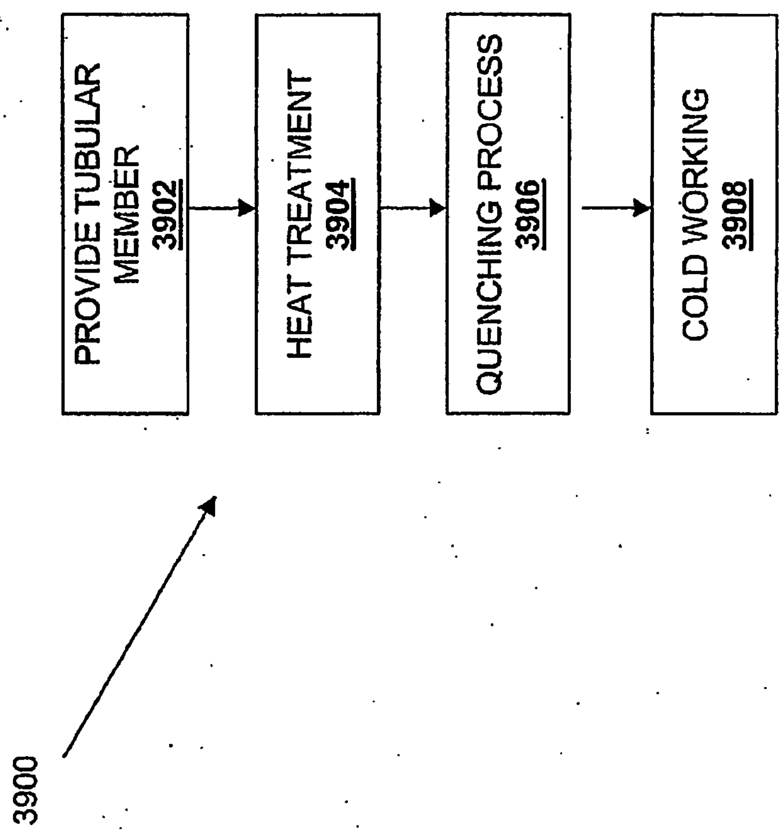

PROVIDE TUBULAR MEMBER
3902
HEAT TREATMENT
3904
QUENCHING PROCESS
3906
COLD WORKING
3908
3900

FIGURE 39

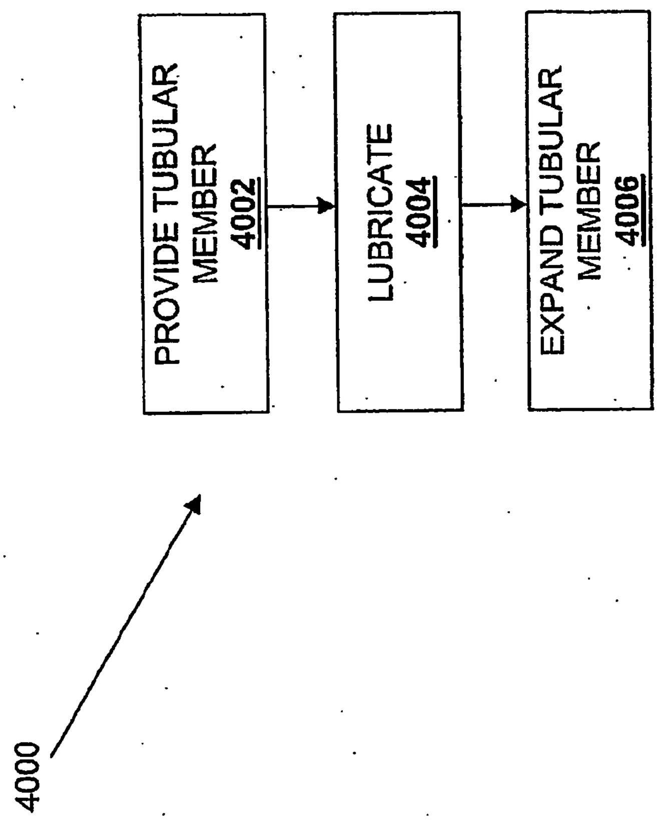

4000
PROVIDE TUBULAR MEMBER
4002
LUBRICATE
4004
EXPAND TUBULAR MEMBER
4006

FIGURE 40

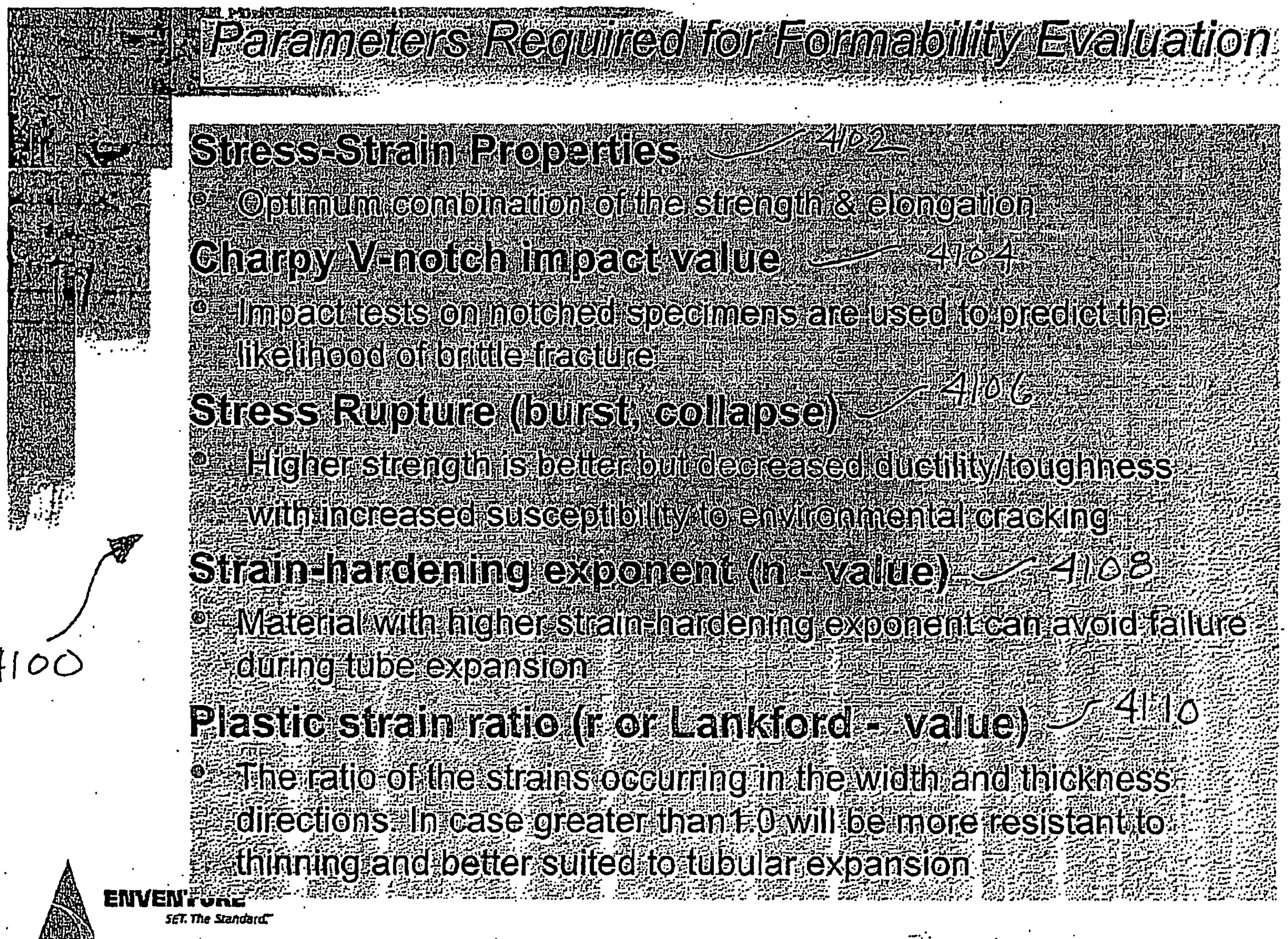
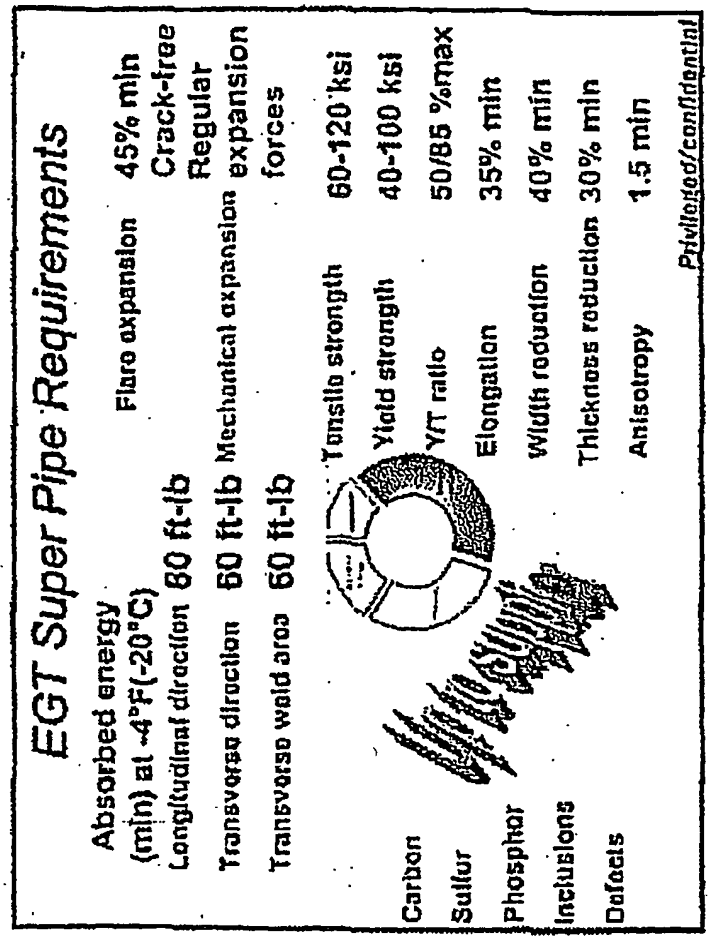

Parameters Required for Formability Evaluation
Stress-Strain Properties
4102
Optimum combination of the strength & elongation
Charpy V-notch impact value
4104
Impact tests on notched specimens are used to predict the likelihood of brittle fracture
Stress Rupture (burst, collapse)
4106
Higher strength is better but decreased ductility/toughness with increased susceptibility to environmental cracking
Strain-hardening exponent (n - value)
4108
Material with higher strain-hardening exponent can avoid failure during tube expansion
Plastic strain ratio (r or Lankford - value)
4110
The ratio of the strains occurring in the width and thickness directions. In case greater than 1.0 will be more resistant to thinning and better suited to tubular expansion
ENVENTURE
SET. The Standard
4100

FIGURE 41



4200

FIGURE 42

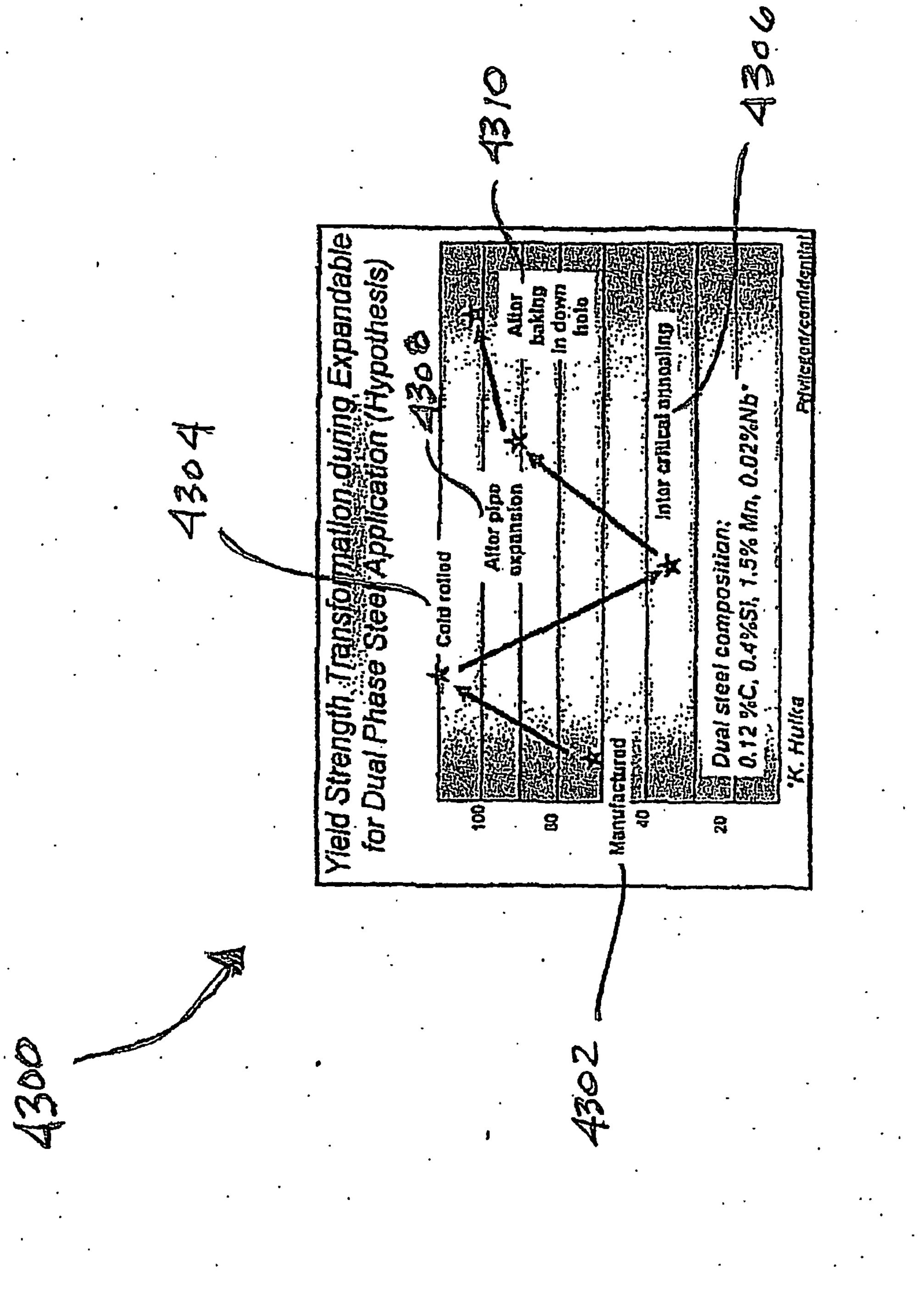
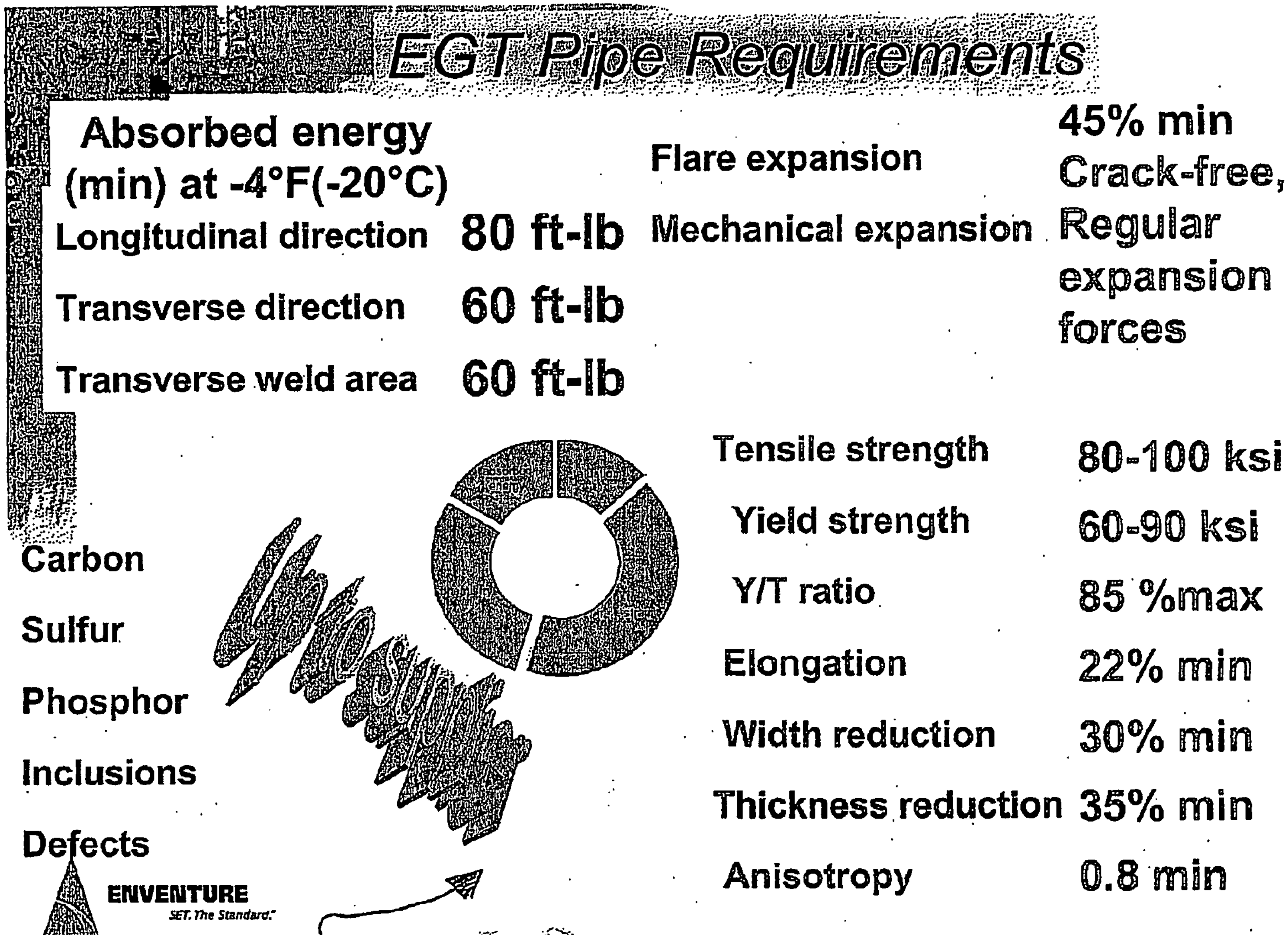

Yield Strength Transformation during Expandable for Dual Phase Steel Application (Hypothesis)
Cold rolled
After pipe expansion
After baking in down hole
Manufactured
Inter critical annealing
100
80
40
20
Dual steel composition;
0.12 %C, 0.4%Si, 1.5% Mn, 0.02%Nb*
*K. Hulka
Privileged/confidential
4300
4302
4304
4306
4308
4310

FIGURE 43



4400

FIGURE 44

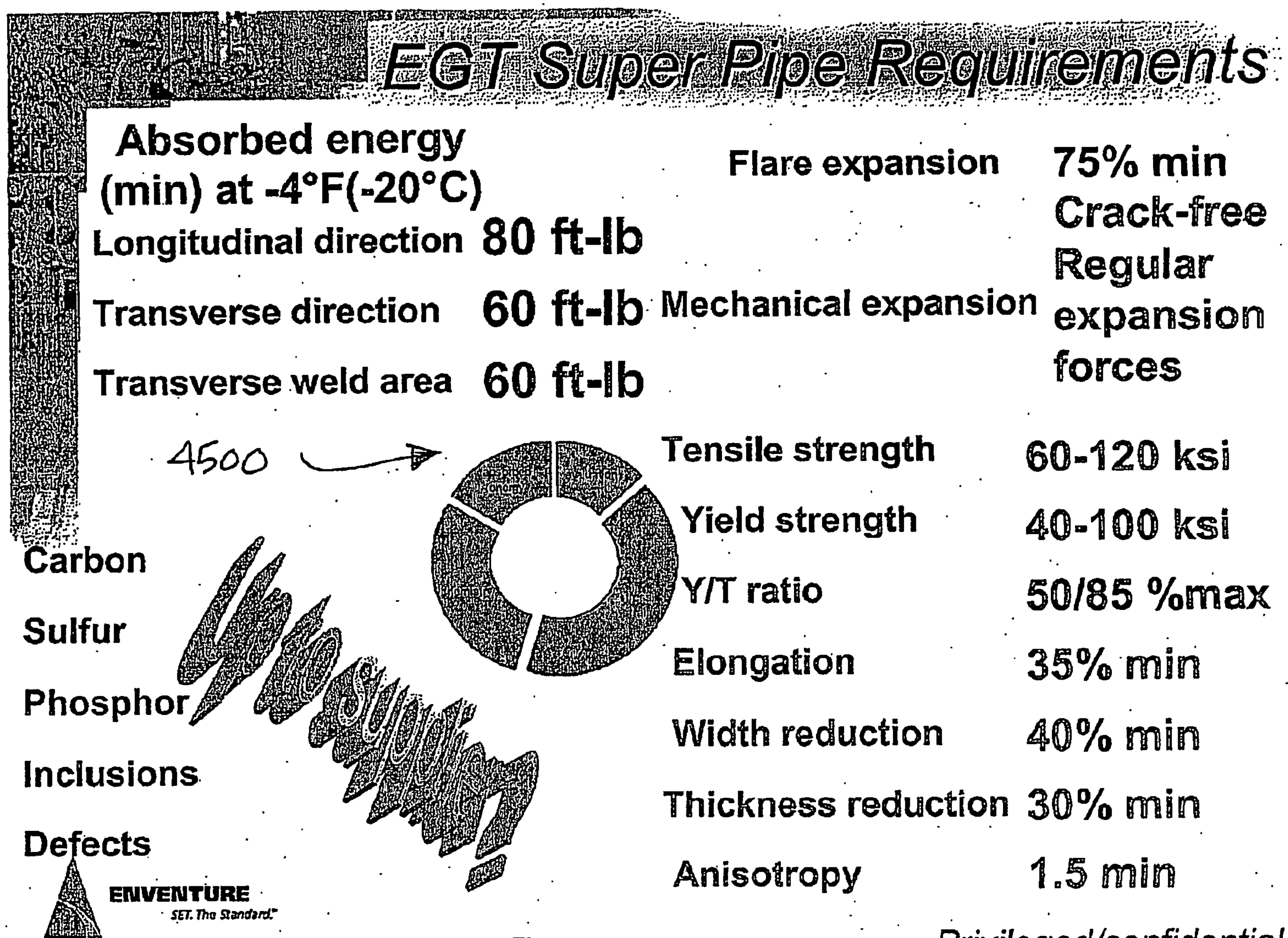

EGT Super Pipe Requirements
Absorbed energy (min) at -4°F(-20°C)
Longitudinal direction 80 ft-lb
Transverse direction 60 ft-lb
Transverse weld area 60 ft-lb
Flare expansion 75% min
Crack-free
Mechanical expansion Regular expansion forces
4500
Tensile strength 60-120 ksi
Yield strength 40-100 ksi
Y/T ratio 50/85 %max
Elongation 35% min
Width reduction 40% min
Thickness reduction 30% min
Anisotropy 1.5 min
Carbon
Sulfur
Phosphor
Inclusions
Defects
ENVENTURE
SET. The Standard.
Privileged/confidential

FIGURE 45

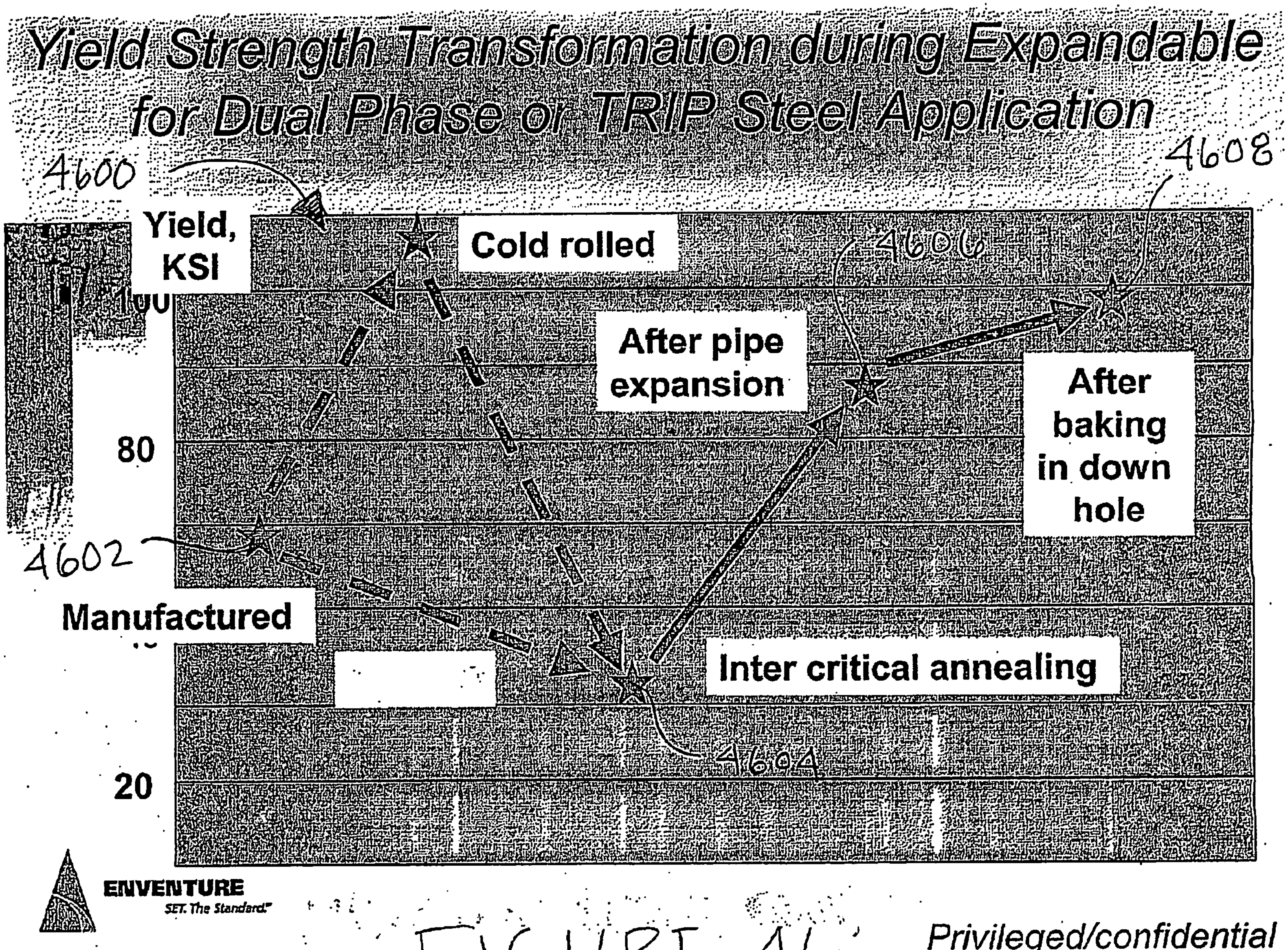

Yield Strength Transformation during Expandable for Dual Phase or TRIP Steel Application
4600
4608
Yield, KSI
Cold rolled
4606
100
After pipe expansion
After baking in down hole
80
4602
Manufactured
Inter critical annealing
4604
20
ENVENTURE
SET. The Standard
Privileged/confidential

FIGURE 46

"History" Pipe Performance*

(High speed tube welding and optimum reducing technology)

- New metallurgy
- Warm-reducing new manufacturing process
- High strength & excellent formability
- 20 % higher elongation
- High r-value (=strain in different directions)

A700

	Yield, ksi	Tensile ksi	Elongation %
"History" pipe	76.8	82.8	32
ERW pipe	64.8	85.0	18

ENVENTURE
SET. The Standard.

FIGURE 47

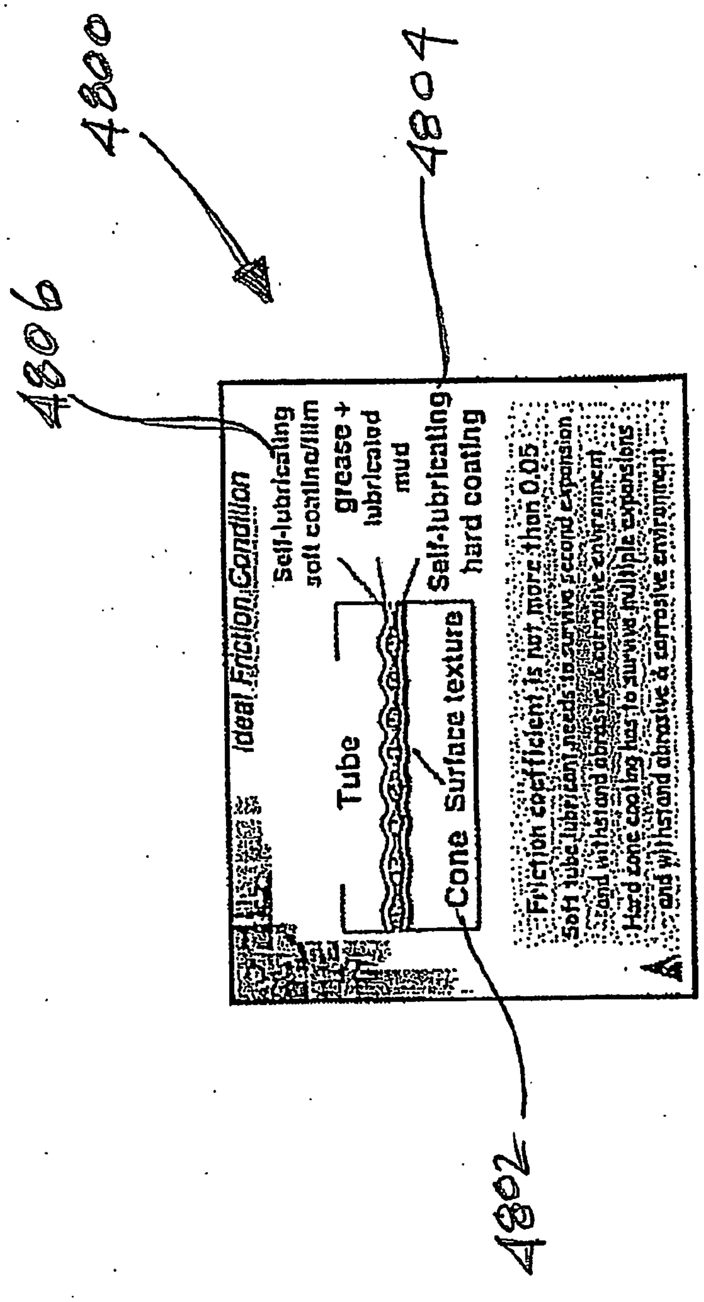

4800
4806
4804
4802
Ideal Friction Condition
Self-lubricating soft coating/film
grease + lubricated mud
Self-lubricating hard coating
Tube
Cone
Surface texture
Friction coefficient is not more than 0.05
Soft tube lubricant needs to survive second expansion and withstand abrasive & corrosive environment
Hard cone coating has to survive multiple expansions and withstand abrasive & corrosive environment

FIGURE 48

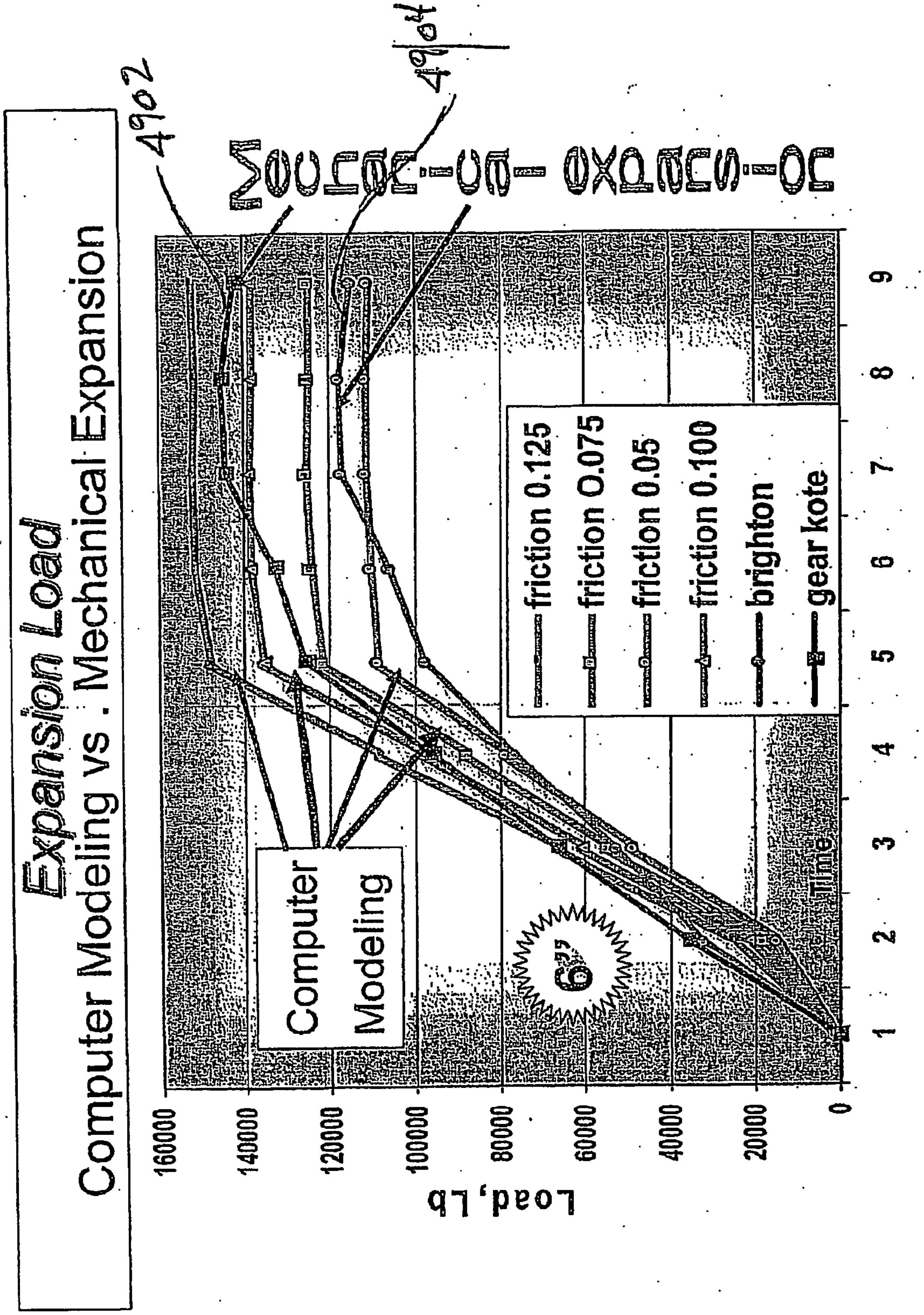
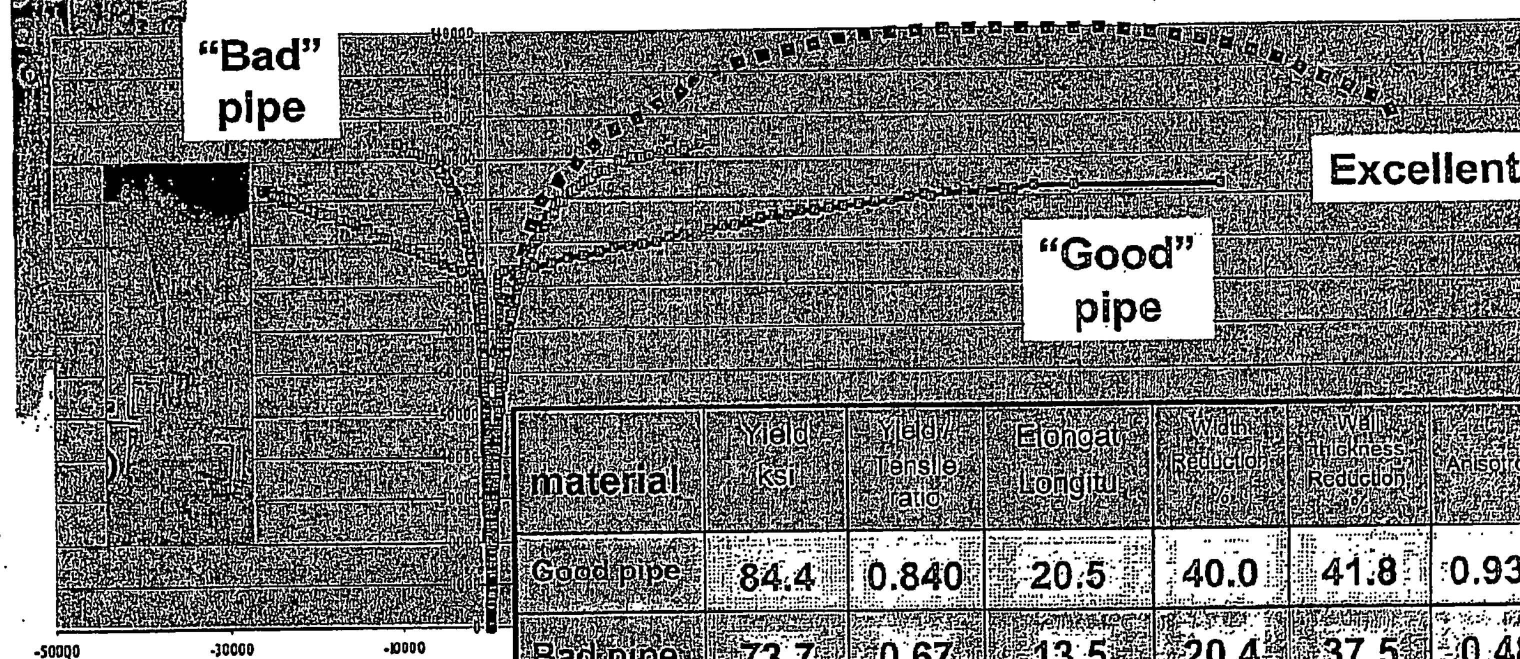

Expansion Load
Computer Modeling vs . Mechanical Expansion
Load, Lb
160000
140000
120000
100000
80000
60000
40000
20000
0
1
2
3
4
5
6
7
8
9
Time
friction 0.125
friction 0.075
friction 0.05
friction 0.100
brighton
gear kote
Computer Modeling
4902
4904

FIGURE 49

Engineering Stress vs. Strain Curve

Hypothetical prediction



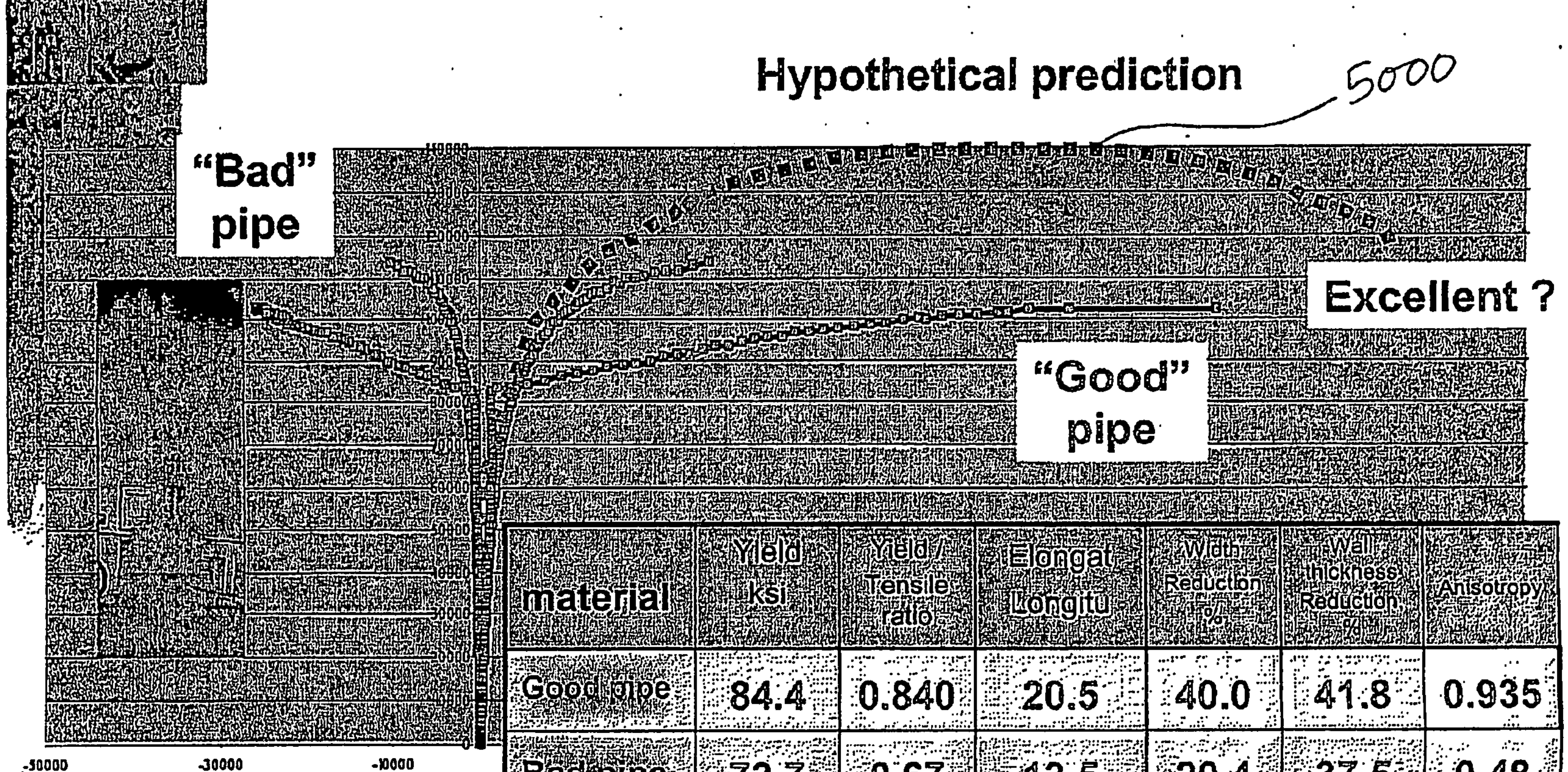
material	Yield Ksi	Yield / Tensile ratio	Elongat Longitu	Width Reduction %	Wall thickness Reduction %	Anisotropy
Good pipe	84.4	0.840	20.5	40.0	41.8	0.935
Bad pipe	73.7	0.67	13.5	20.4	37.5	0.48
Excellent	40/80	<0.5	>30	>45	>30	>1.5

5000

ENVENTURE
SET. The Standard.

FIGURE 50a

Engineering Stress vs. Strain Curve



material	Yield ksi	Yield / Tensile ratio	Elongat Longitu	Width Reduction %	Wall thickness Reduction %	Anisotropy
Good pipe	84.4	0.840	20.5	40.0	41.8	0.935
Bad pipe	73.7	0.67	13.5	20.4	37.5	0.48
Excellent	40/80	<0.5	>30	>45	>30	>1.5

ENVENTURE
SET. The Standard

FIGURE 50b

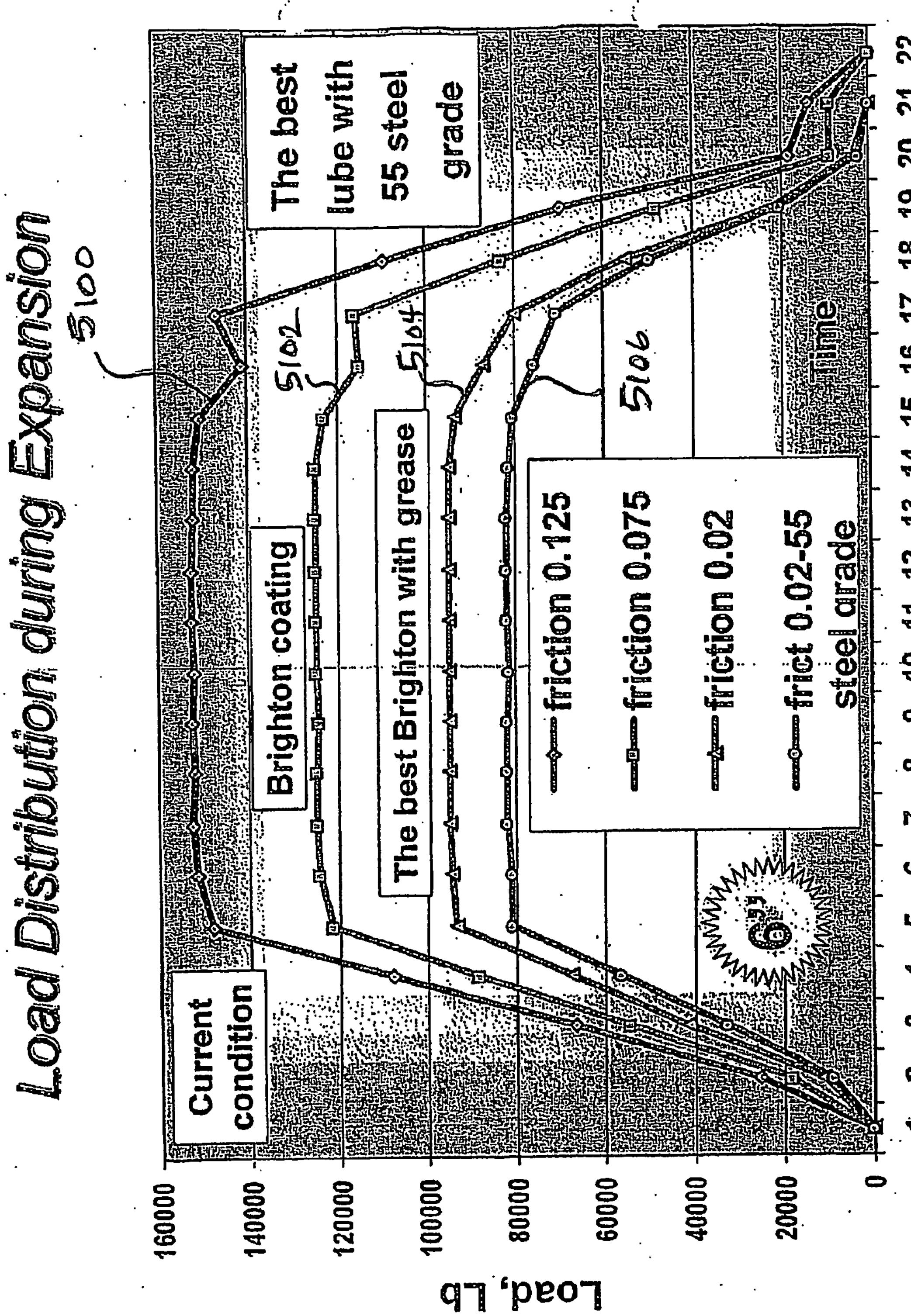

Load Distribution during Expansion
5100
5102
5104
5106
Current condition
Brighton coating
The best Brighton with grease
The best lube with 55 steel grade
friction 0.125
friction 0.075
friction 0.02
friction 0.02
frict 0.02-55 steel grade
Load, Lb
160000
140000
120000
100000
80000
60000
40000
20000
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
Time

FIGURE 51

Collapse Improvement Estimation

6"

	Friction	Expansion force	Wall thickness	D/t after	Collapse Ksi
5200 Current 6" x .305 BSFL lube	0.125	145,900	0.305	24.8	2,379
5202 Brighton lube Application	0.075	143,000	0.350	21.6	3,243
5204 Best Brighton With grease	0.02	149,900	0.450	16.8	5,837
5206 Best lube with 55 ksi steel	0.02	125,800	0.500	15.1	5,359
5208 Best lube and steel with 55 Ksi yield before and 100 Ksi after pipe expansion	0.02	126,800	0.500	15.1	8,443

FIGURE 52

Pipe Compositions

Sample	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	Nb	Ti
JFE-A*	.065	1.44	.01	.002	.24	.01	.01	.02	04	.01	.03	.01
JFE-B*	.18	1.28	.017	.004	0.29	.01	.01	.03	.03	.03	.01	.01
X52x0.37	.08	.82	.006	.003	.30	.16	.05	.05	.06	.01	.03	.01
X52x0.52	.03	1.48	.014	.002	.16	.02	.01	0.02	06	.01	.03	.01

5302
5304
5306
5308

FIGURE 53

5400

Tensile Characteristics before and after Mechanical Expansion

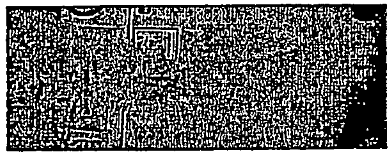
NT 55HE Pipe, 16 %

	Yield ksi (5402)	Yield ratio (5404)	Elongation % (5406)	Width reduction % (5408)	Wall thickness reduction, % (5410)	Anisotropy % (5412)
Before	61.5	.62	17	26	47	.46
After	74.7	.77	14	28	54	.44
Change %	21.4	24	- 18	7.7	14.5	- 4.4

FIGURE 54

5500

Tensile Characteristics before and after Mechanical Expansion



JFE "History" Pipe, 15.6 %

5502 5504 5506 5508 5510 5512

	Yield ksi	Yield ratio	Elongation %	Width reduction %	Wall thickness reduction, %	Anisotropy %
Before	61.9	.6	12	18	15	1.24
After,	105	.75	4	13	14	.94
Change %	-70	-25	- 67	27.8	6.7	75

FIGURE 55

5600

Tensile Characteristics before and after Mechanical Expansion

VM 50, 24 %

	Yield ksi (5602)	Yield ratio (5604)	Elongation % (5606)	Width reduction % (5608)	Wall thickness reduction, % (5610)	Anisotropy % (5612)
Before	64.9	.78	20	47	59	.72
After	71.5	.80	14	41	58	.60
Change %	10.2	2.6	- 30	- 13	- 1.7	- 16.7

FIGURE 56

5700

Tensile Characteristics before and after Mechanical Expansion

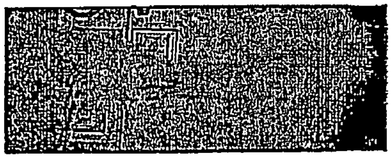
JFE option A

	Yield ksi 5702	Yield ratio 5704	Elongation% 5706	Width reduction 5708 %	Wall thickness reduction, % 5710	Anisotropy % 5712
Before	46.9	.69	53	-52	55	.93
16 % Expan.	65.9	.83	17	42	51	.78
24 % Expan	68.5	.83	5	44	54	.76
Change %	46	-20	91	15	2	18

FIGURE 57

Tensile Characteristics before and after Mechanical Expansion

5800



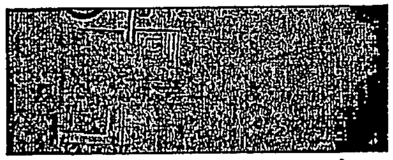
JFE, option A (#1) 16 %

	Yield ksi (5802)	Yield ratio (5804)	Elongation % (5806)	Width reduction % (5808)	Wall thickness reduction % (5810)	Anisotropy % (5812)
Before	47.7	.69	23	46	53	0.81
After	65.9	.83	17	42	51	0.78
Change %	38	20	11	9	4	4

FIGURE 58

Tensile Characteristics before and after Mechanical Expansion

5900



JFE, option A (#1) 24 %

5902 5904 5906 5908 5910 5912

	Yield ksi	Yield ratio	Elongation %	Width reduction %	Wall thickness reduction %	Anisotropy %
Before	47.7	.69	23	46	53	0.81
After	62.3	.71	12	40	52	.71
Change %	31	14	48	13	2	12

FIGURE 59

6000

Tensile Characteristics before and after Mechanical Expansion JFE option B

	Yield ksi 6002	Yield ratio 6004	Elongation% 6006	Width reduction 6008 %	Wall thickness reduction, % 6010	Anisotropy % 6012
Before	57.8	.71	44	43	46	.93
16 % Expan.	74.4	.84	16	38	42	.87
24 % Expan	79.8	.86	20	36	42	.81
Changes, %	38	-21	55	16	9	13

FIGURE 60

6100

Tensile Characteristics before and after Mechanical Expansion

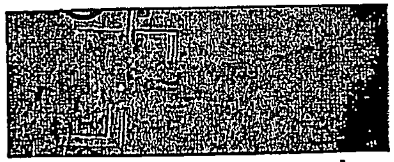
JFE, option B (#2) 16 %

	Yield ksi (6102)	Yield ratio (6104)	Elongation % (6106)	Width reduction % (6108)	Wall thickness reduction, % (6110)	Anisotropy % (6112)
Before	56.4	.66	20	-39	-45	.83
After	74.8	.83	14	33	41	.75
Change %	33	26	30	15	9	10

FIGURE 61

6200

Tensile Characteristics before and after Mechanical Expansion



JFE, option B (#2) 24 %

	6202	6204	6206	6208	6210	6212
	Yield ksi	Yield ratio	Elongation %	Width reduction %	Wall thickness reduction, %	Anisotropy %
Before	56.4	.66	20	-39	-45	.83
After	79.6	.84	12	31	38	.79
Change %	41	27	40	21	16	5

FIGURE 62

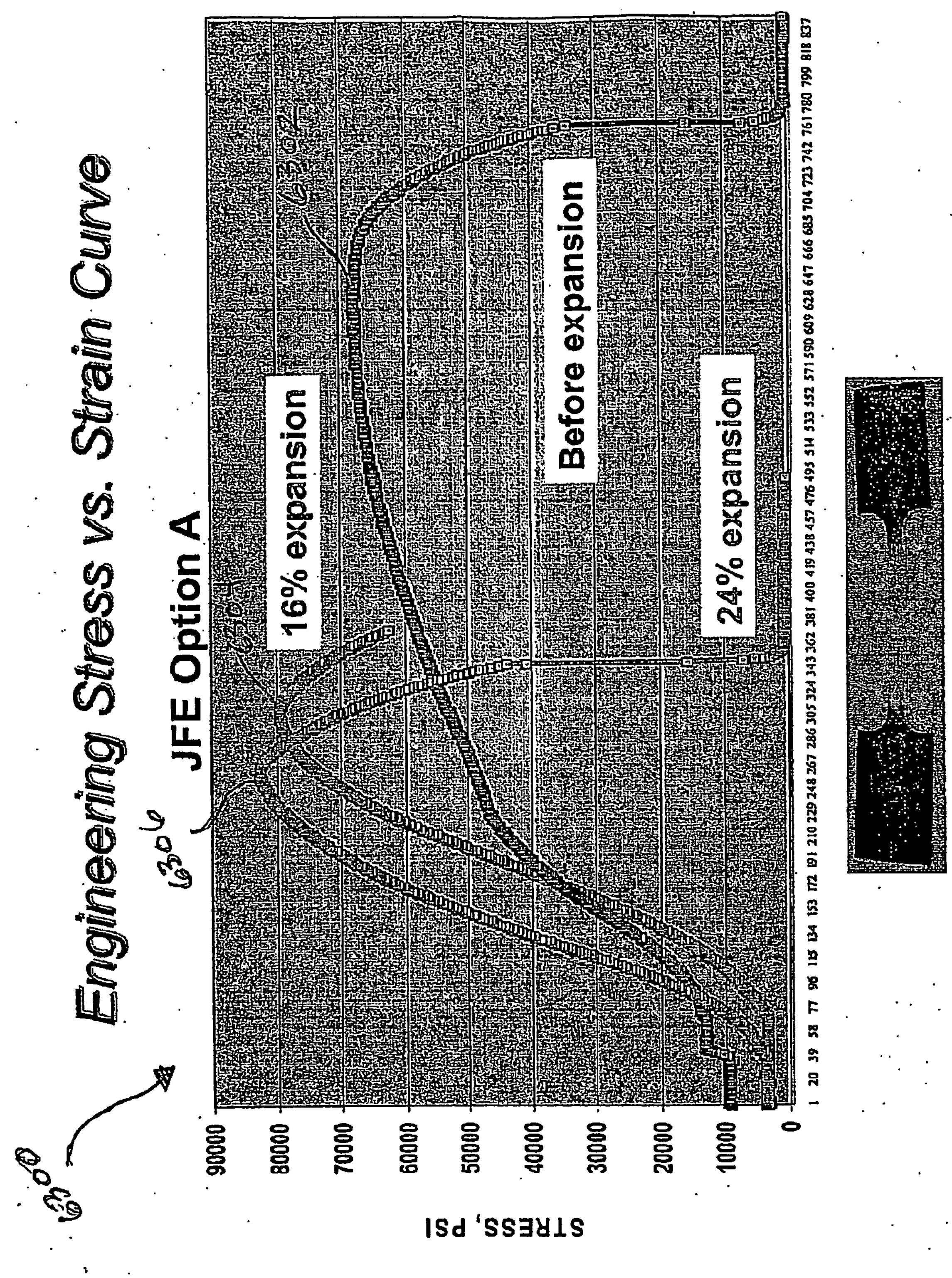

6300
Engineering Stress vs. Strain Curve
JFE Option A
6306
6304
6302
16% expansion
Before expansion
24% expansion
STRESS, PSI
90000
80000
70000
60000
50000
40000
30000
20000
10000
0

FIGURE 63

Engineering Stress vs. Strain Curve

JFE – A (#1)

6400

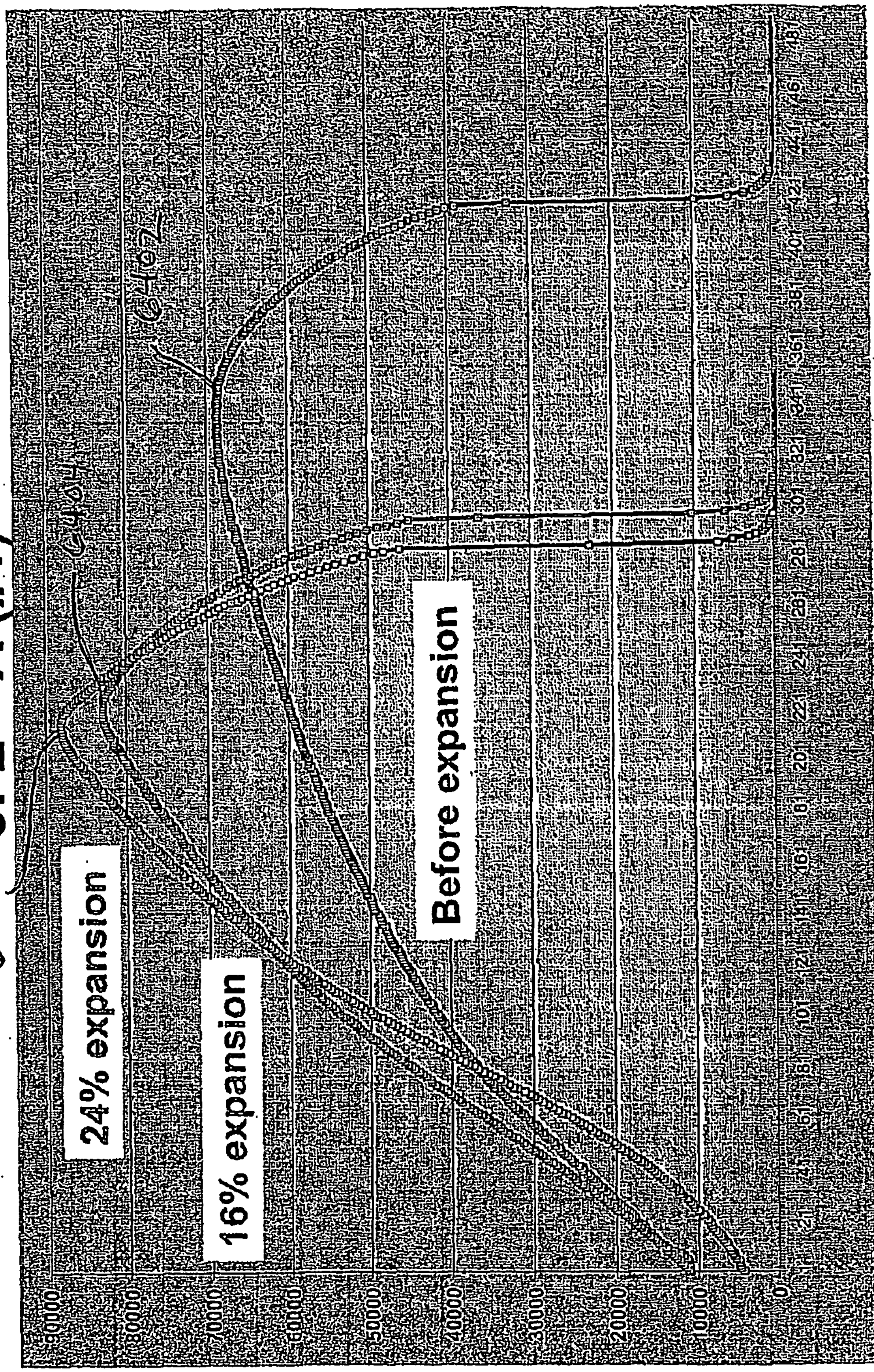


FIGURE 64

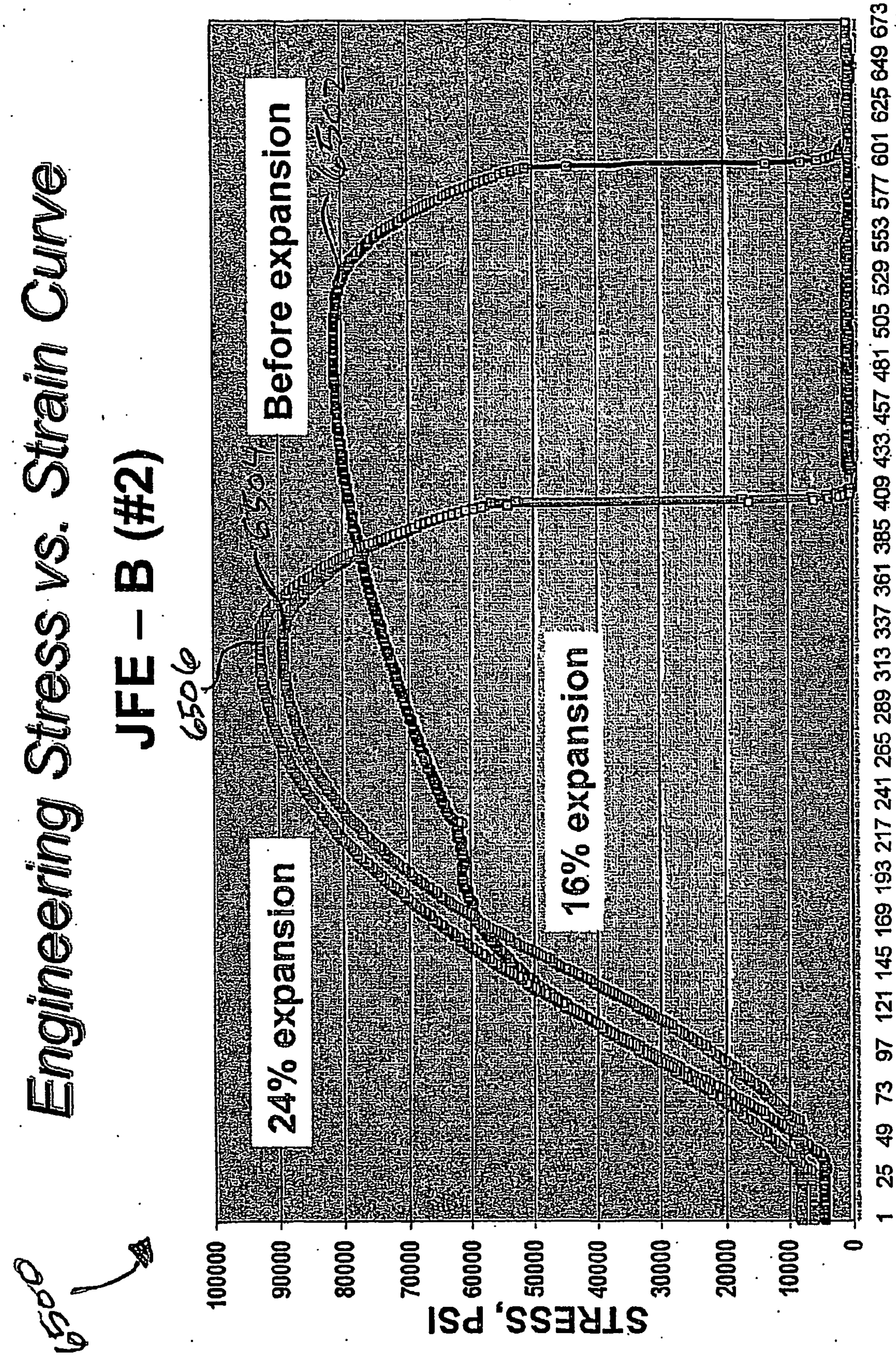

Engineering Stress vs. Strain Curve
JFE – B (#2)
Before expansion
24% expansion
16% expansion
STRESS, PSI
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
1 25 49 73 97 121 145 169 193 217 241 265 289 313 337 361 385 409 433 457 481 505 529 553 577 601 625 649 673
6500
6502
6504
6506

FIGURE 65

6600

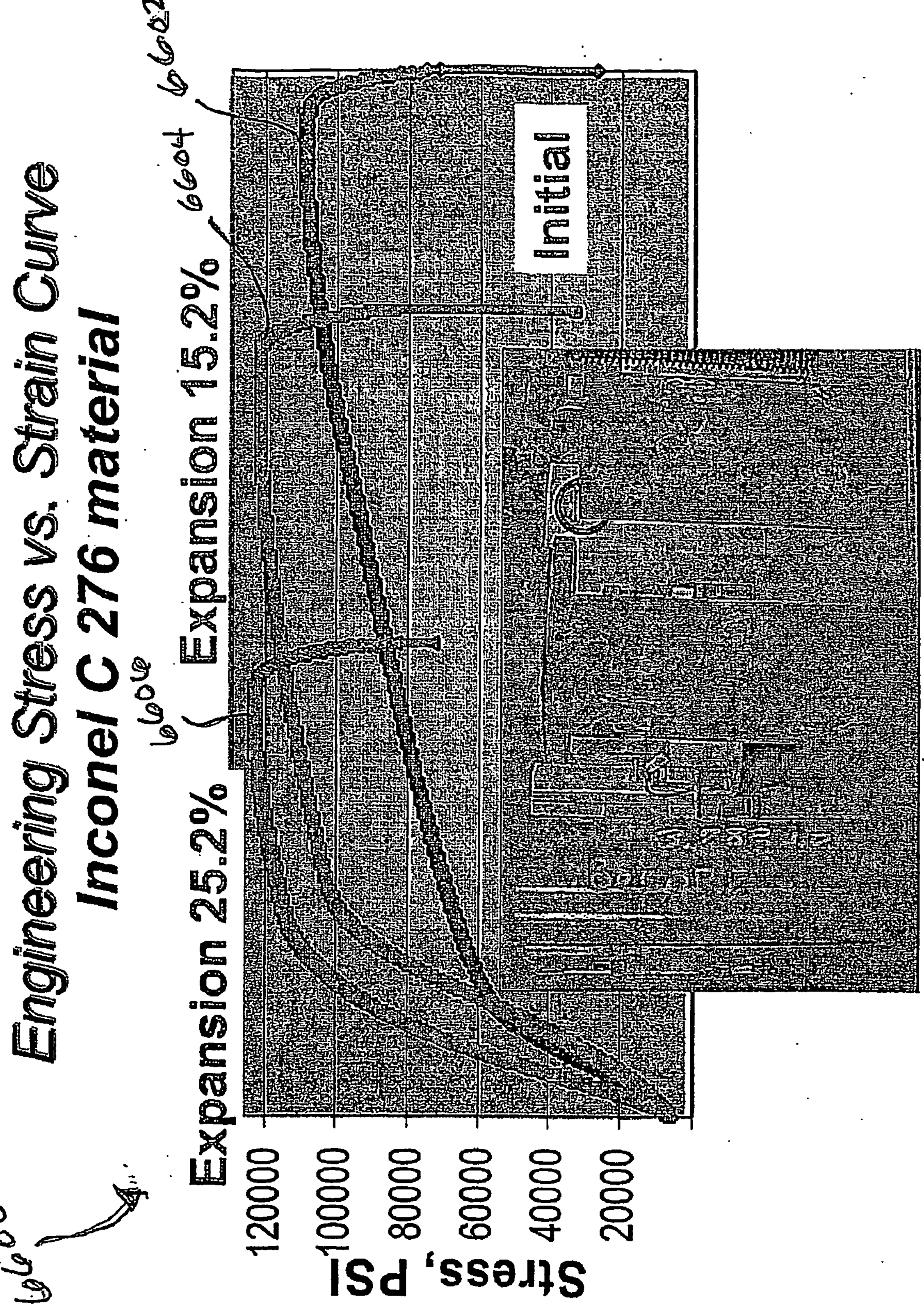


FIGURE 66

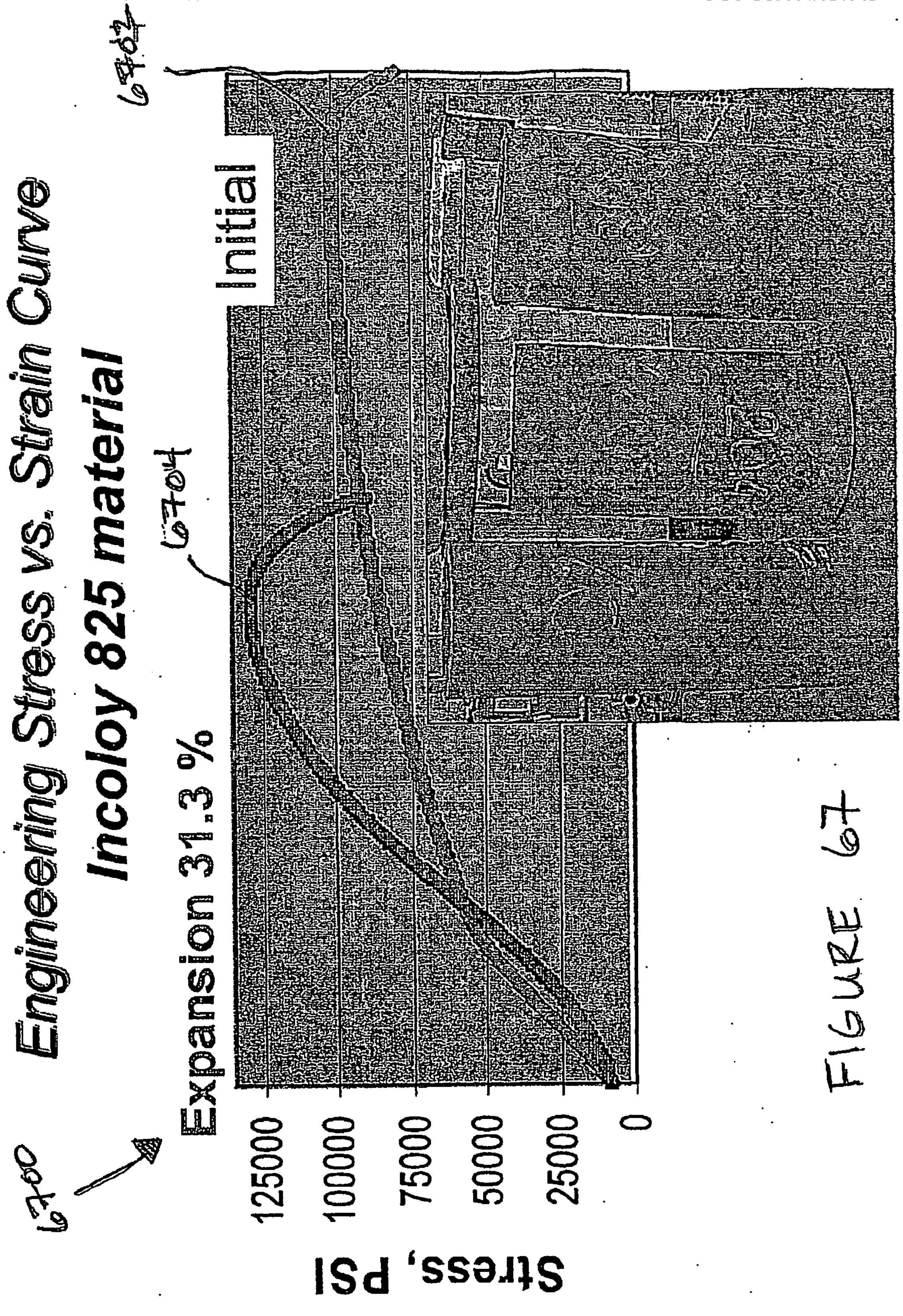
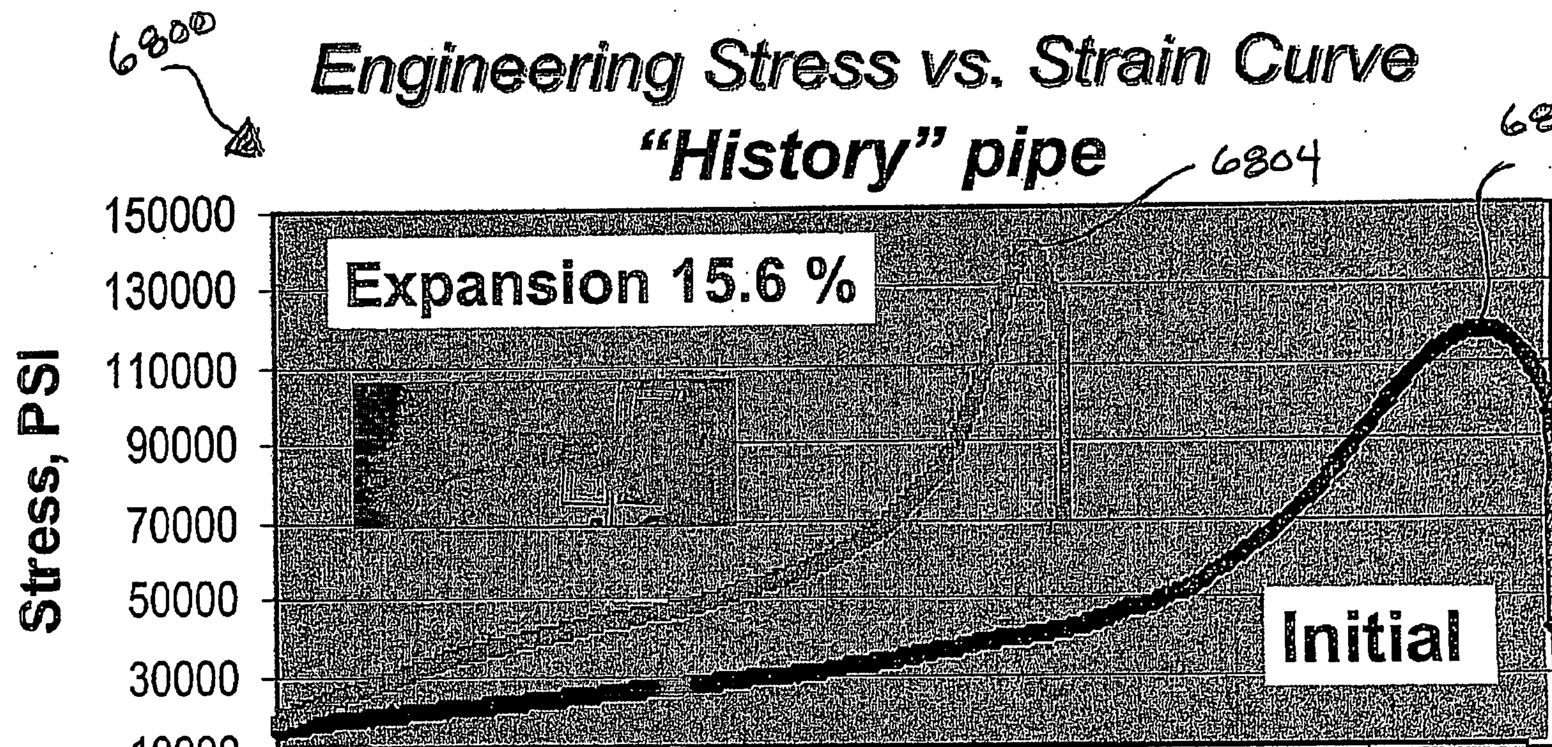

Engineering Stress vs. Strain Curve
Incoloy 825 material
Expansion 31.3 %
Initial
Stress, PSI
125000
100000
75000
50000
25000
0
6700
6702
6704

FIGURE 67

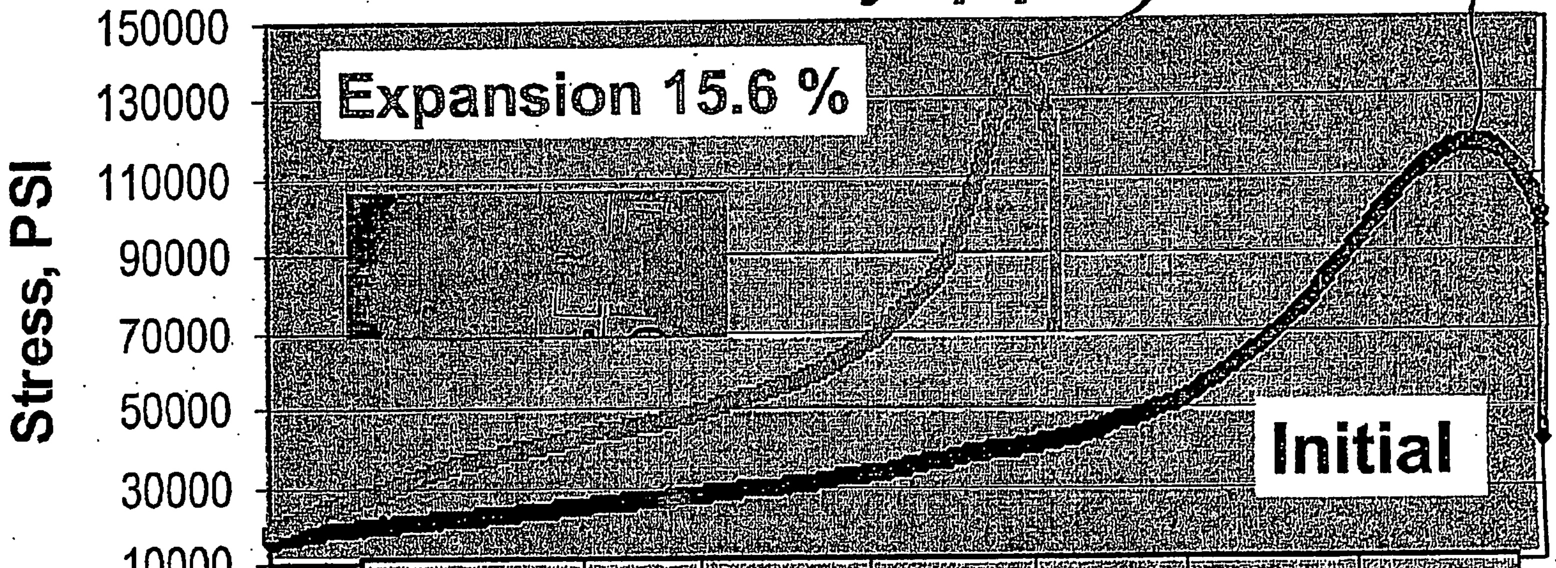


material	Yield ksi	Yield / Tensile ratio	Elongation Longitudinal %	Width Reduction %	Wall thickness Reduction, %	Anisotropy
target	76.8	0.82	16	32	45	0.65
History	50.7	0.44	12	18	15	1.24

FIGURE 68a

6800

Engineering Stress vs. Strain Curve
"History" pipe



material	Yield ksi	Yield / Tensile ratio	Elongation Longitudinal %	Width Reduction %	Wall thickness Reduction, %	Anisotropy
target	76.8	0.82	16	32	45	0.65
History	50.7	0.44	12	18	15	1.24

6806

FIGURE 68b

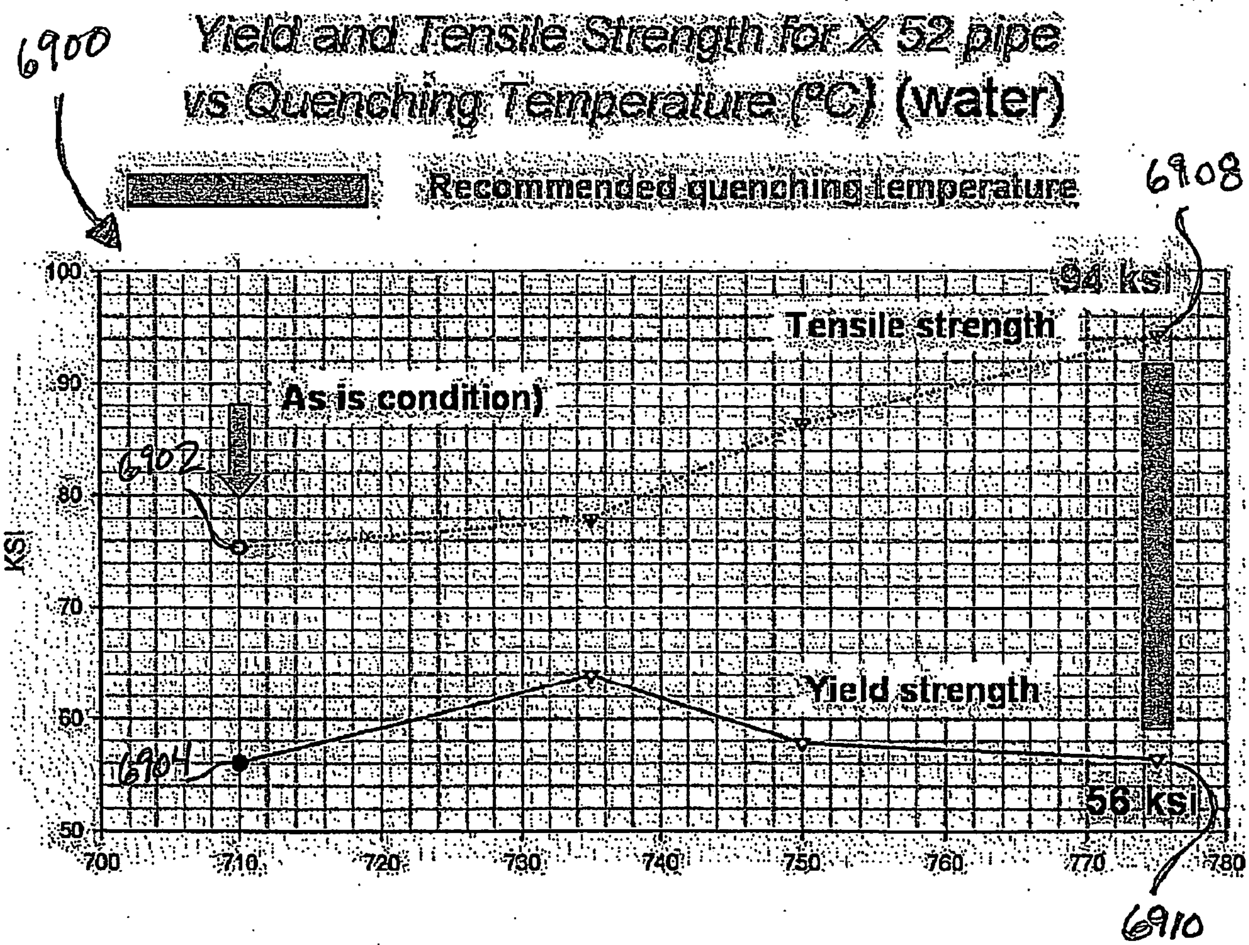

6900
Yield and Tensile Strength for X 52 pipe
vs Quenching Temperature (°C) (water)
Recommended quenching temperature
6908
94 ksi
Tensile strength
As is condition)
6902
6904
Yield strength
56 ksi
6910
KSI
100
90
80
70
60
50
700
710
720
730
740
750
760
770
780

FIGURE 69

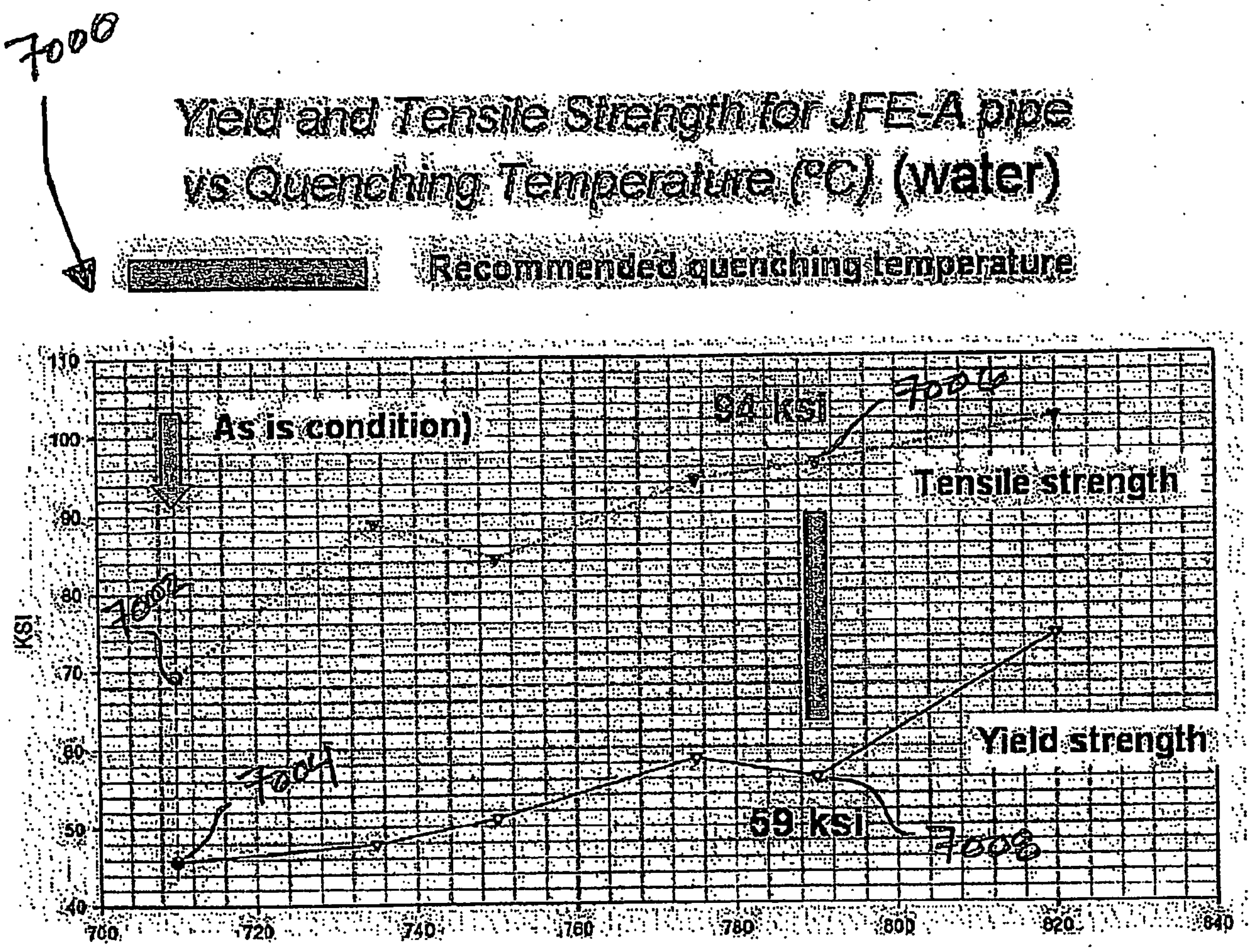

7000
Yield and Tensile Strength for JFE-A pipe
vs Quenching Temperature (°C) (water)
Recommended quenching temperature
As is condition)
94 ksi
7006
Tensile strength
7002
KSI
Yield strength
7004
59 ksi
7008
110
100
90
80
70
60
50
40
700
720
740
760
780
800
820
840

FIGURE 70

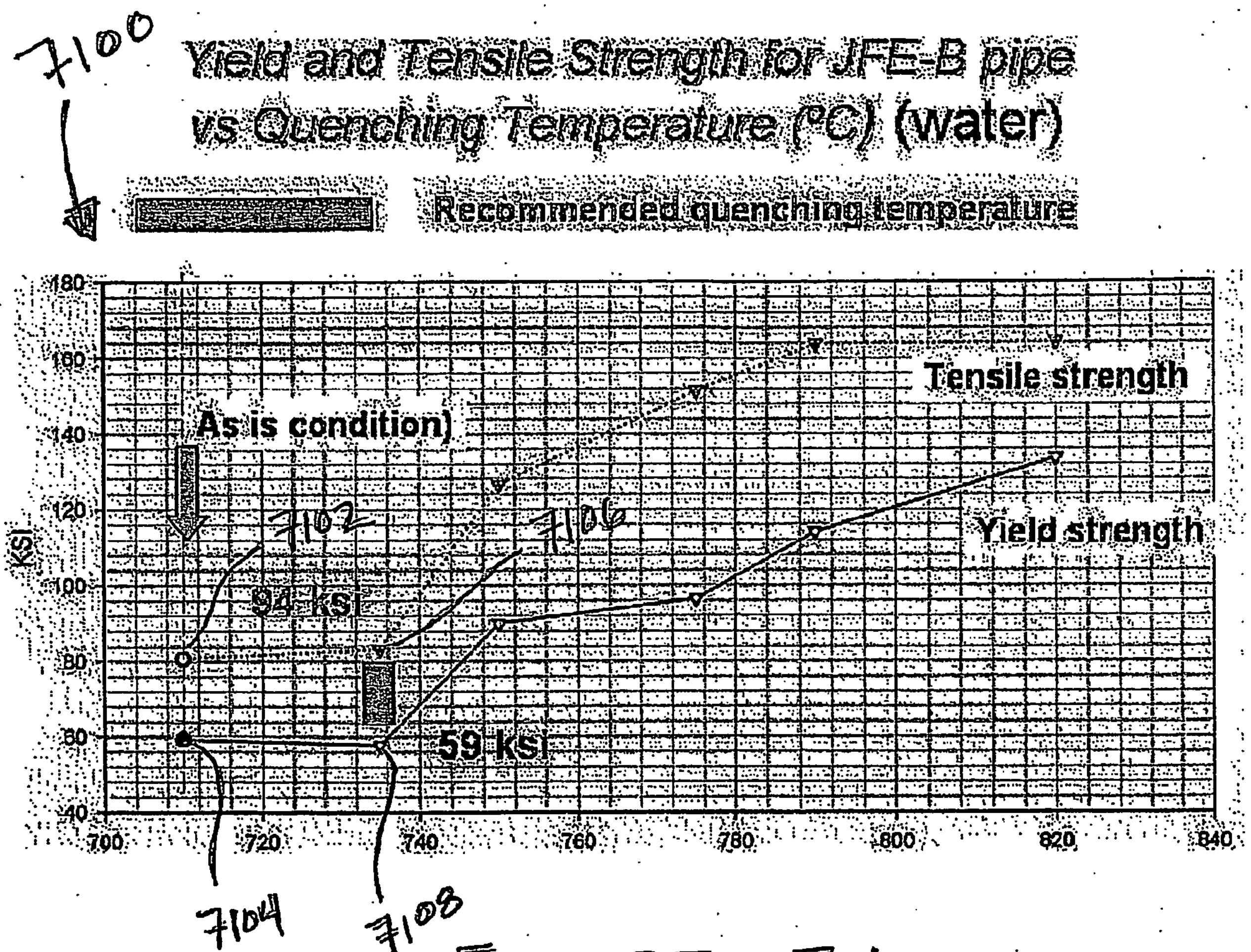

7100
Yield and Tensile Strength for JFE-B pipe
vs Quenching Temperature (°C) (water)
Recommended quenching temperature
Tensile strength
Yield strength
As is condition)
94 ksi
59 ksi
7102
7106
7104
7108
KSI
180
160
140
120
100
80
60
40
700
720
740
760
780
800
820
840

FIGURE 71

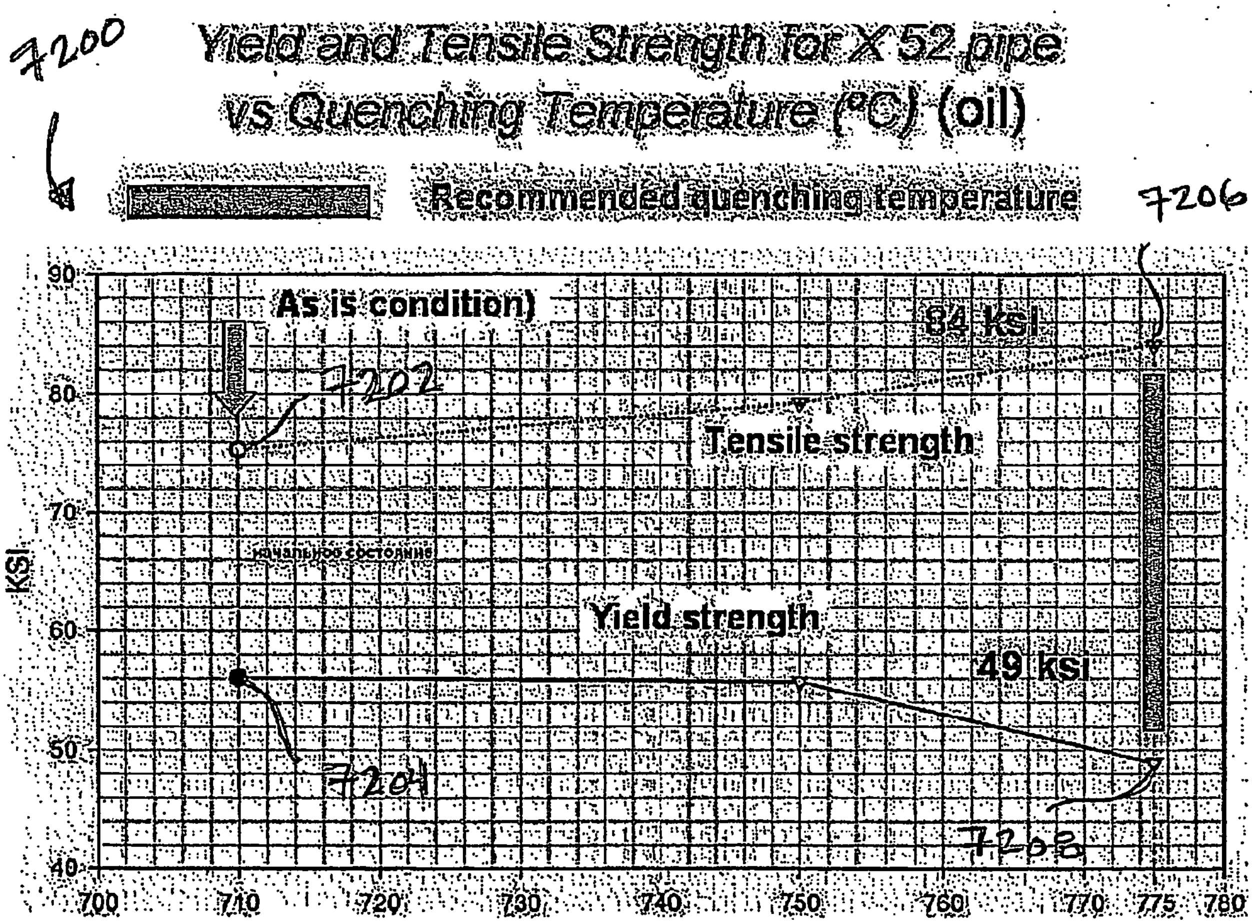

7200
Yield and Tensile Strength for X 52 pipe
vs Quenching Temperature (°C) (oil)
Recommended quenching temperature
7206
As is condition)
84 ksi
7202
Tensile strength
начальное состояние
Yield strength
49 ksi
7204
7208
KSI
90
80
70
60
50
40
700
710
720
730
740
750
760
770
775
780

FIGURE 72

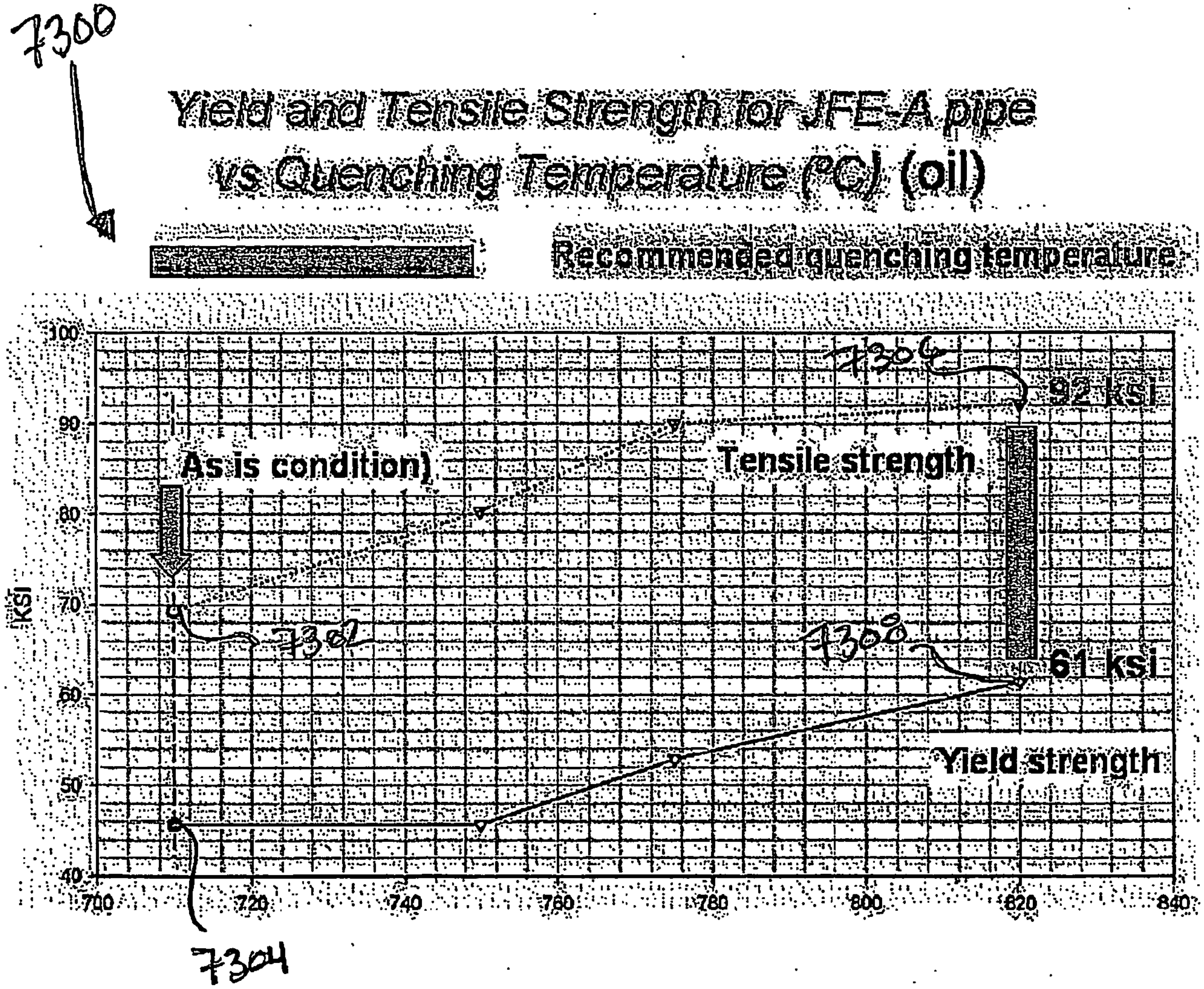

7300
Yield and Tensile Strength for JFE-A pipe
vs Quenching Temperature (°C) (oil)
Recommended quenching temperature
100
90
80
70
60
50
40
KSI
As is condition)
Tensile strength
7306
92 ksi
7302
7308
61 ksi
Yield strength
7304
700
720
740
760
780
800
820
840

FIGURE 73

7400

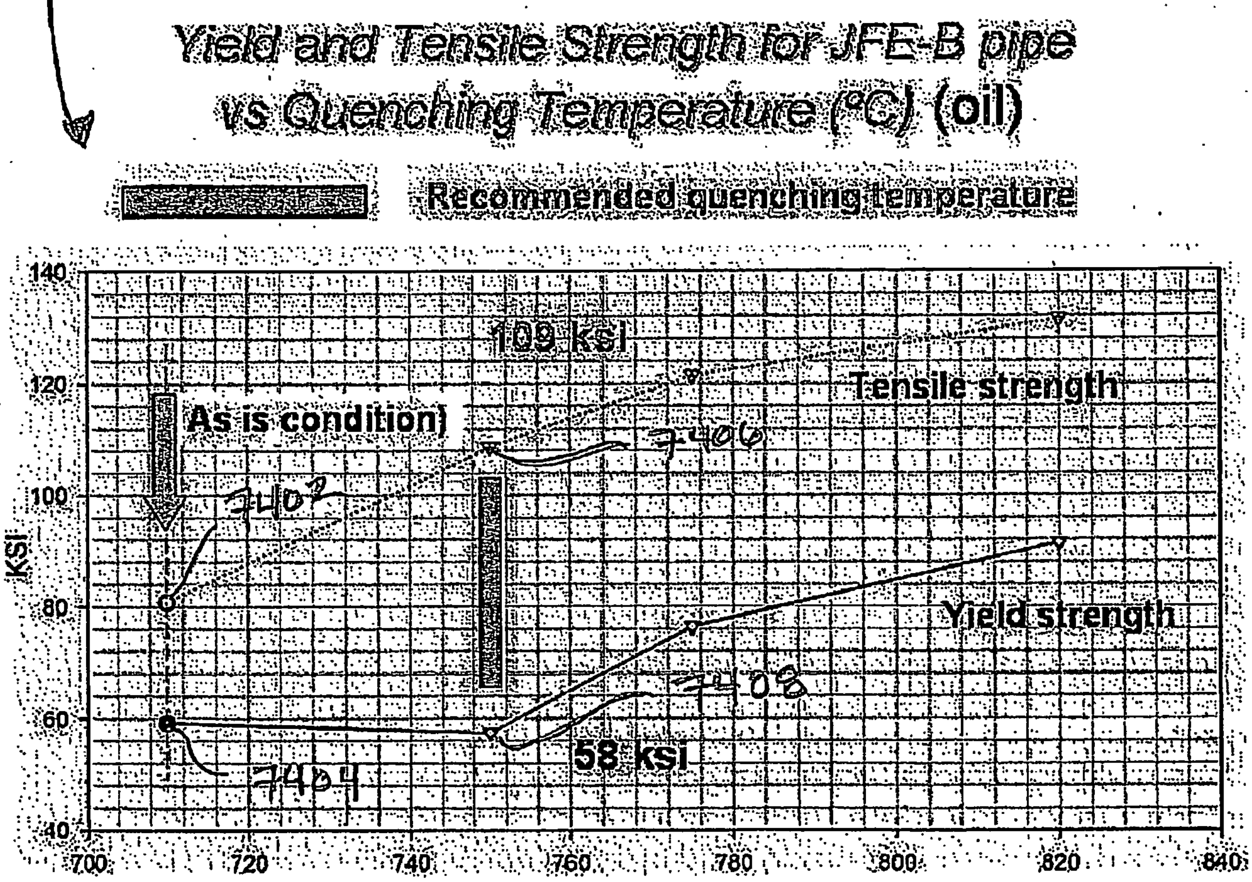


FIGURE 74

Stress-Strain Property of the Target vs. Quench & Temper N Steel Pipes*

material	Yield, ksi 7506	Yield / Tensile ratio 7508	Elongation Longitudinal % 7510	Width Reduction % 7512	Wall thickness Reduction % 7514	Anisotropy 7516
target 7500	80.18	0.857	14.75 *	38.3	43.0	0.868
7502 Quench & temper pipe-1	81.25	0.829	14.88 *	37.8	43.25	0.830
7504 Quench & temper pipe-2	78.77	0.822	15.90 *	44.0	43.33	1.03

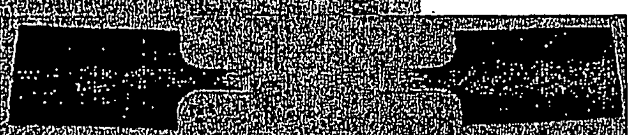
*An average from 4 measurements

* 5 " base line

FIGURE 75

Stress-Strain Property of the Target vs. Quench & Temper Nippon Steel Pipes*

material	Yield ksi 7504	Yield / Tensile ratio 7506	Elongation Longitudinal % 7508	Width Reduction % 7510	Wall thickness Reduction % 7512	Anisotropy 7514
target 7500	80.18	0.857	14.75*	38.3	43.0	0.868
Quench & temper pipe 7502	80.19	0.826	15.25*	40.4	43.3	0.915



***An average from 4 (target) and 8 (quench & temper measurements**

***5 " base line**

FIGURE 76

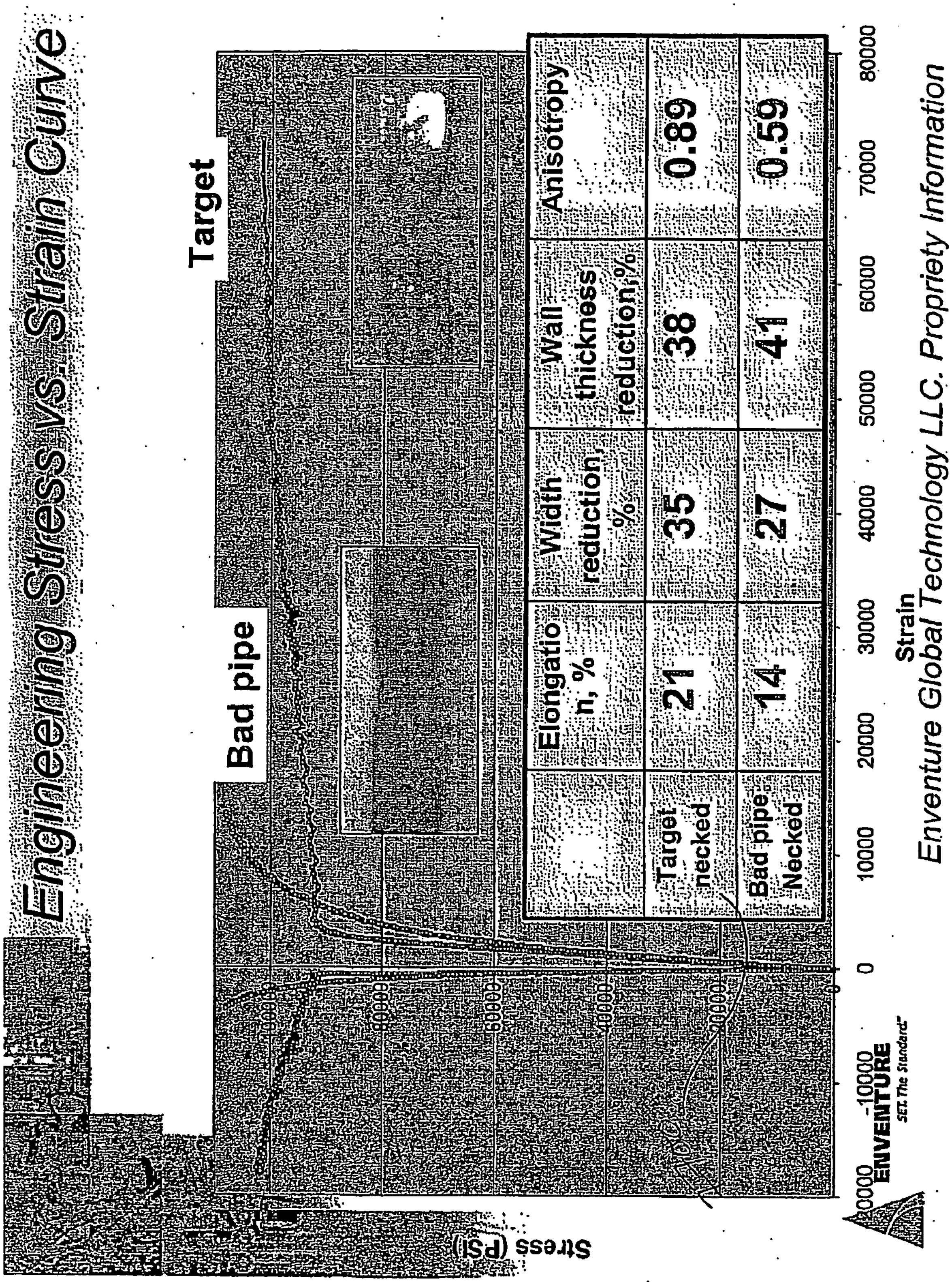

Engineering Stress vs. Strain Curve
Target
Bad pipe
Stress (PSI)
Strain
-10000
0
10000
20000
30000
40000
50000
60000
70000
80000
	Elongation, %	Width reduction, %	Wall thickness reduction,%	Anisotropy
Target necked	21	35	38	0.89
Bad pipe Necked	14	27	41	0.59
ENVENTURE
SET. The Standard
Enventure Global Technology LLC. Propriety Information

FIGURE 77a

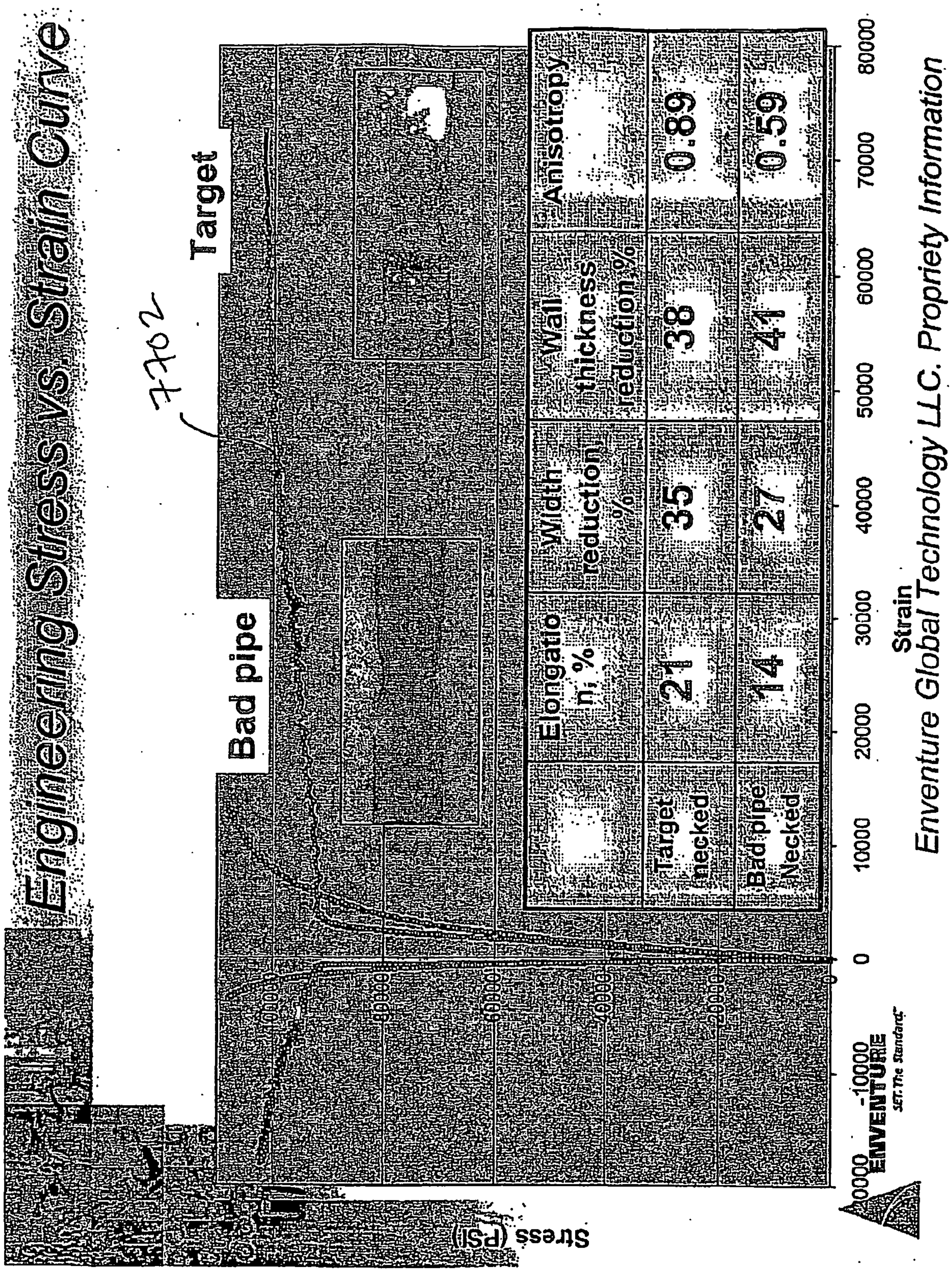
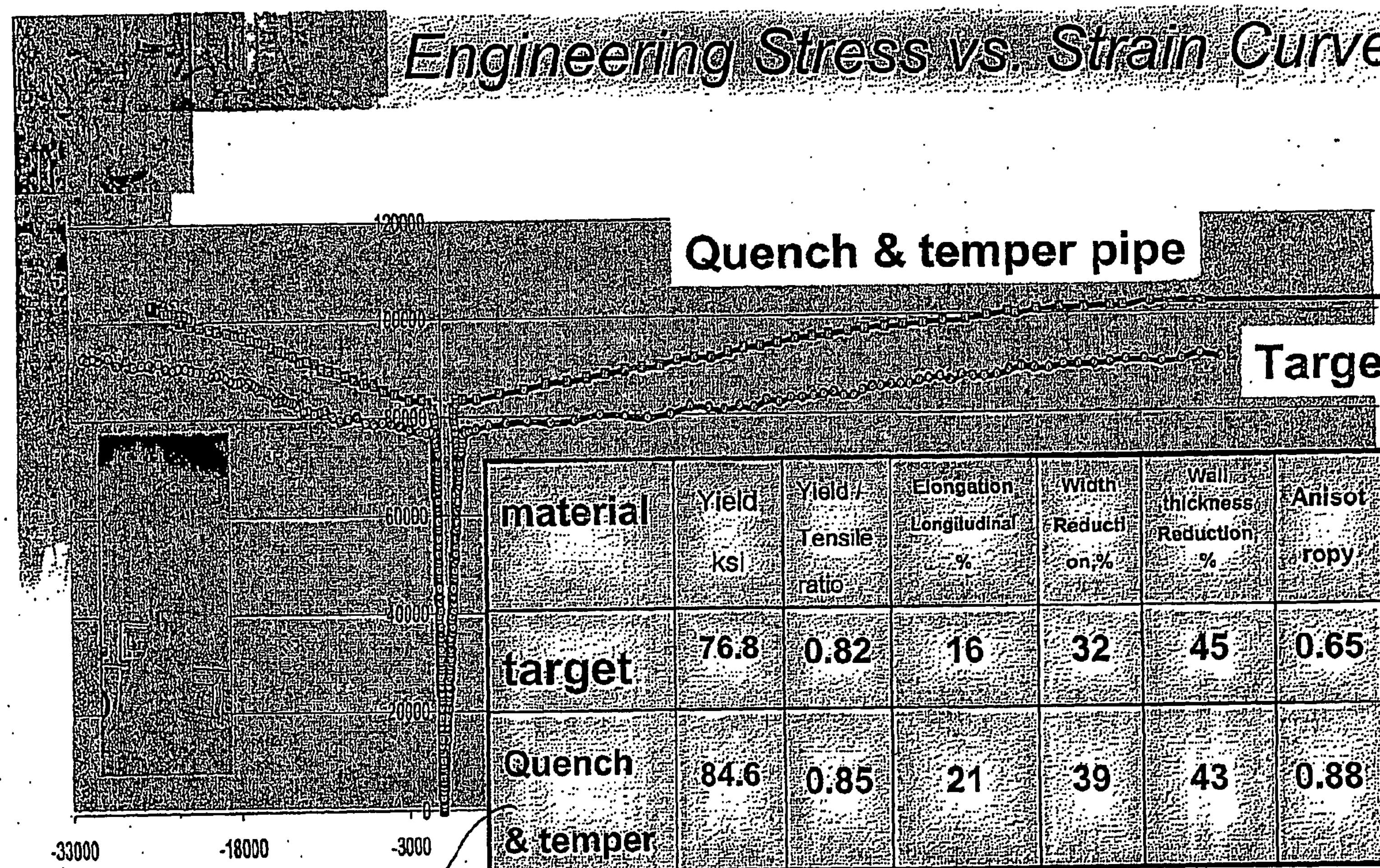

Engineering Stress vs. Strain Curve
Bad pipe
Target
7702
Stress (PSI)
Strain
0
10000
20000
30000
40000
50000
60000
70000
80000
-10000
ENVENTURE
SET. The Standard
Elongation, %
Width reduction %
Wall thickness reduction %
Anisotropy
Target necked
21
35
38
0.89
Bad pipe Necked
14
27
41
0.59
Enventure Global Technology LLC. Propriety Information

FIGURE 77b

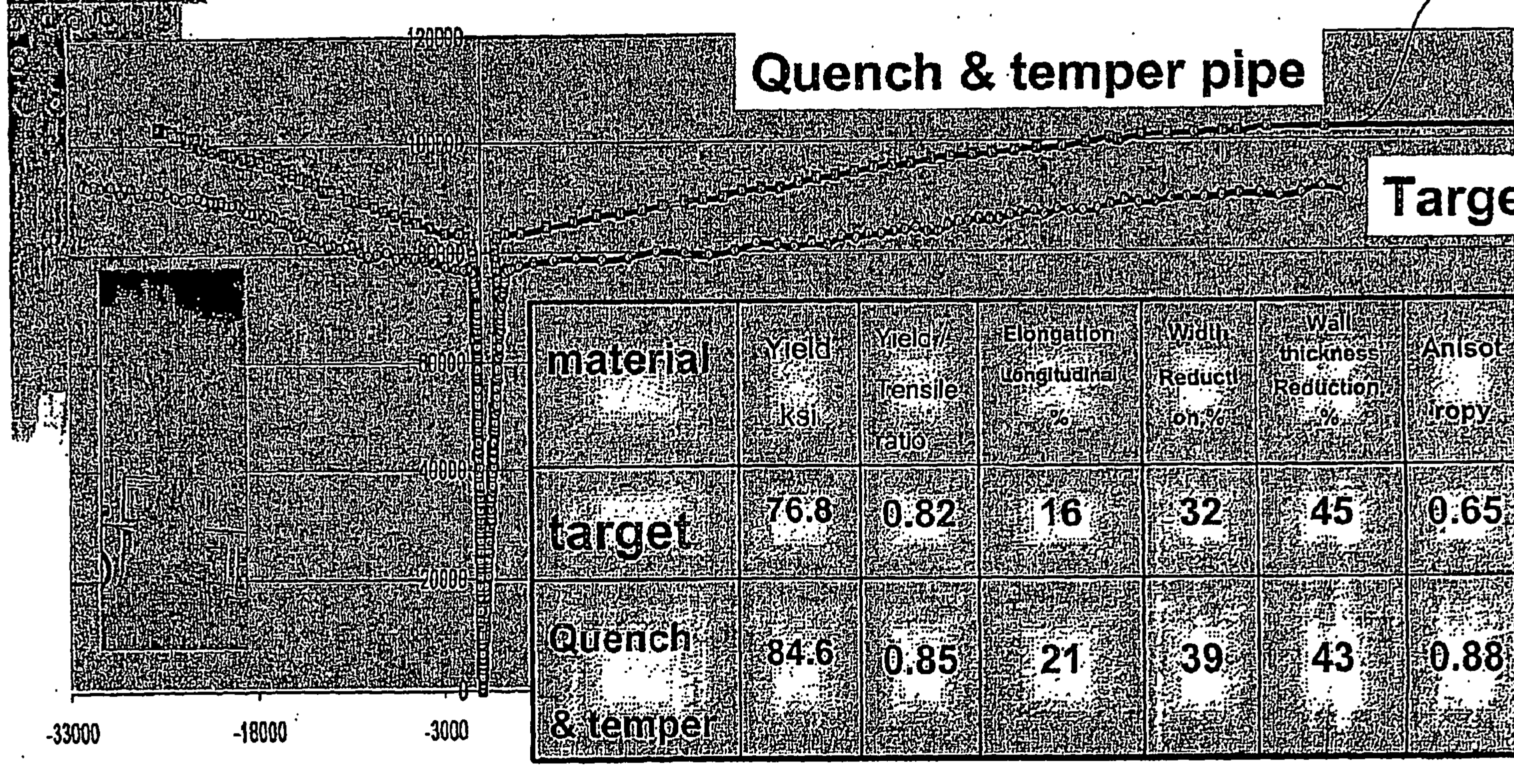


material	Yield ksi	Yield / Tensile ratio	Elongation Longitudinal %	Width Reduction,%	Wall thickness Reduction %	Anisotropy
target	76.8	0.82	16	32	45	0.65
Quench & temper	84.6	0.85	21	39	43	0.88

FIGURE 78a

Enventure Global Technology LLC. Propriety Information

Engineering Stress vs. Strain Curve



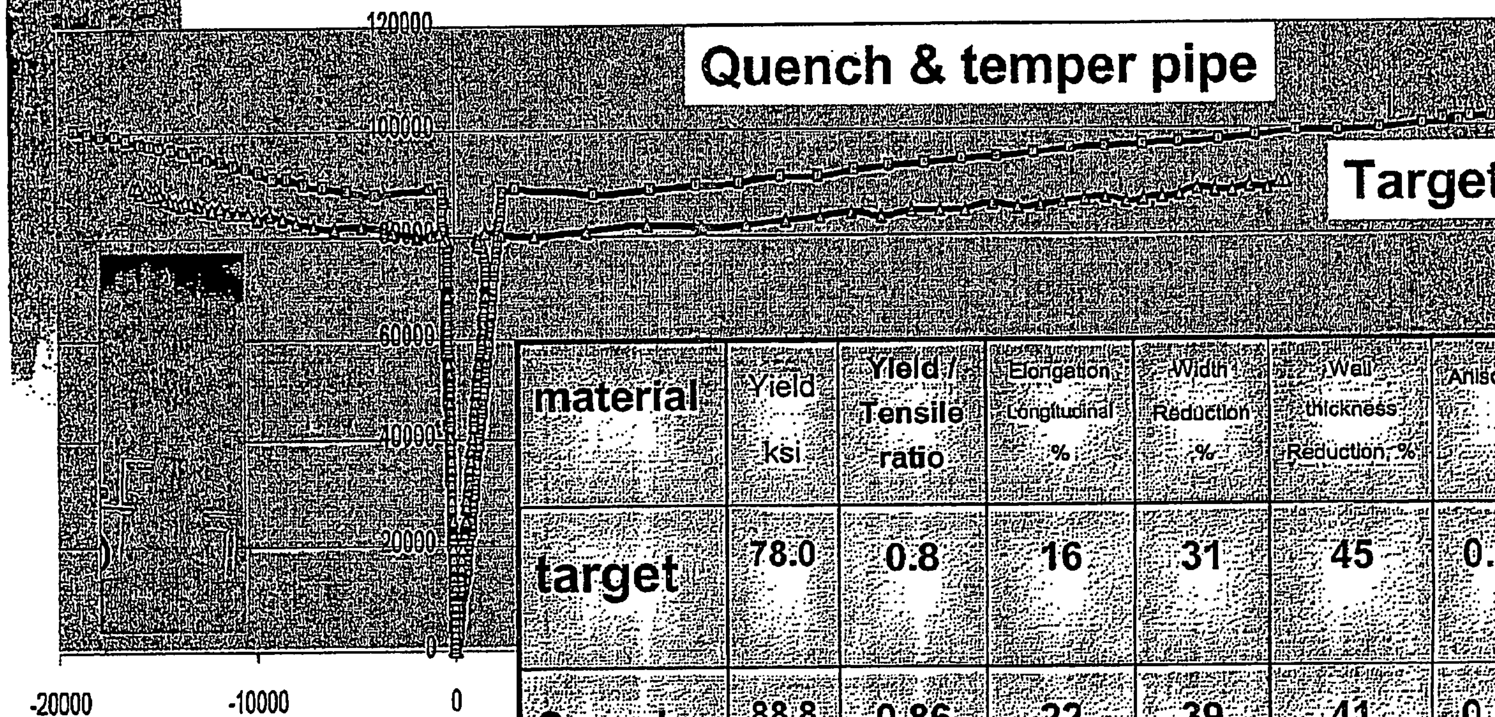
material	Yield ksi	Yield / Tensile Ratio	Elongation longitudinal %	Width Reduction %	Wall thickness Reduction %	Anisotropy
target	76.8	0.82	16	32	45	0.65
Quench & temper	84.6	0.85	21	39	43	0.88

FIGURE 78b

ENVENTURE
SET. The Standard

Enventure Global Technology LLC. Propriety Information

Engineering Stress vs. Strain Curve



material	Yield ksi	Yield / Tensile ratio	Elongation Longitudinal %	Width Reduction %	Wall thickness Reduction %	Anisotropy
target	78.0	0.8	16	31	45	0.63
Quench & temper	88.8	0.86	22	39	41	0.93

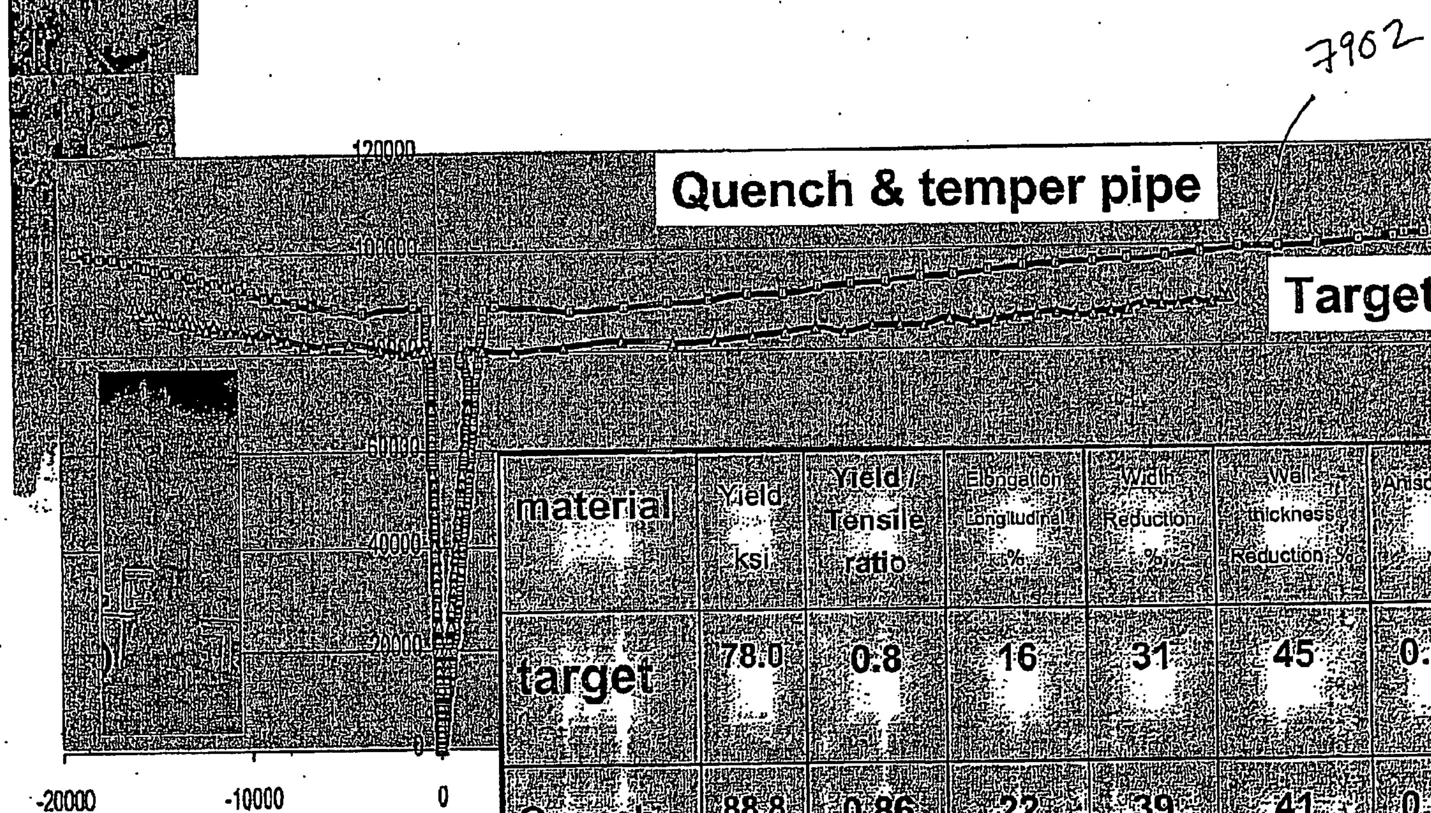
7900

ENVENTURE SET. The Standard

Enventure Global Technology LLC. Propriety Information

FIGURE 79a

Engineering Stress vs. Strain Curve



material	Yield ksi	Yield / Tensile ratio	Elongation Longitudinal %	Width Reduction %	Wall thickness Reduction %	Anisotropy
target	78.0	0.8	16	31	45	0.63
Quench & temper	88.8	0.86	22	39	41	0.93

ENVENTURE
SET. The Standard.

Enventure Global Technology LLC. Propriety Information

FIGURE 79b

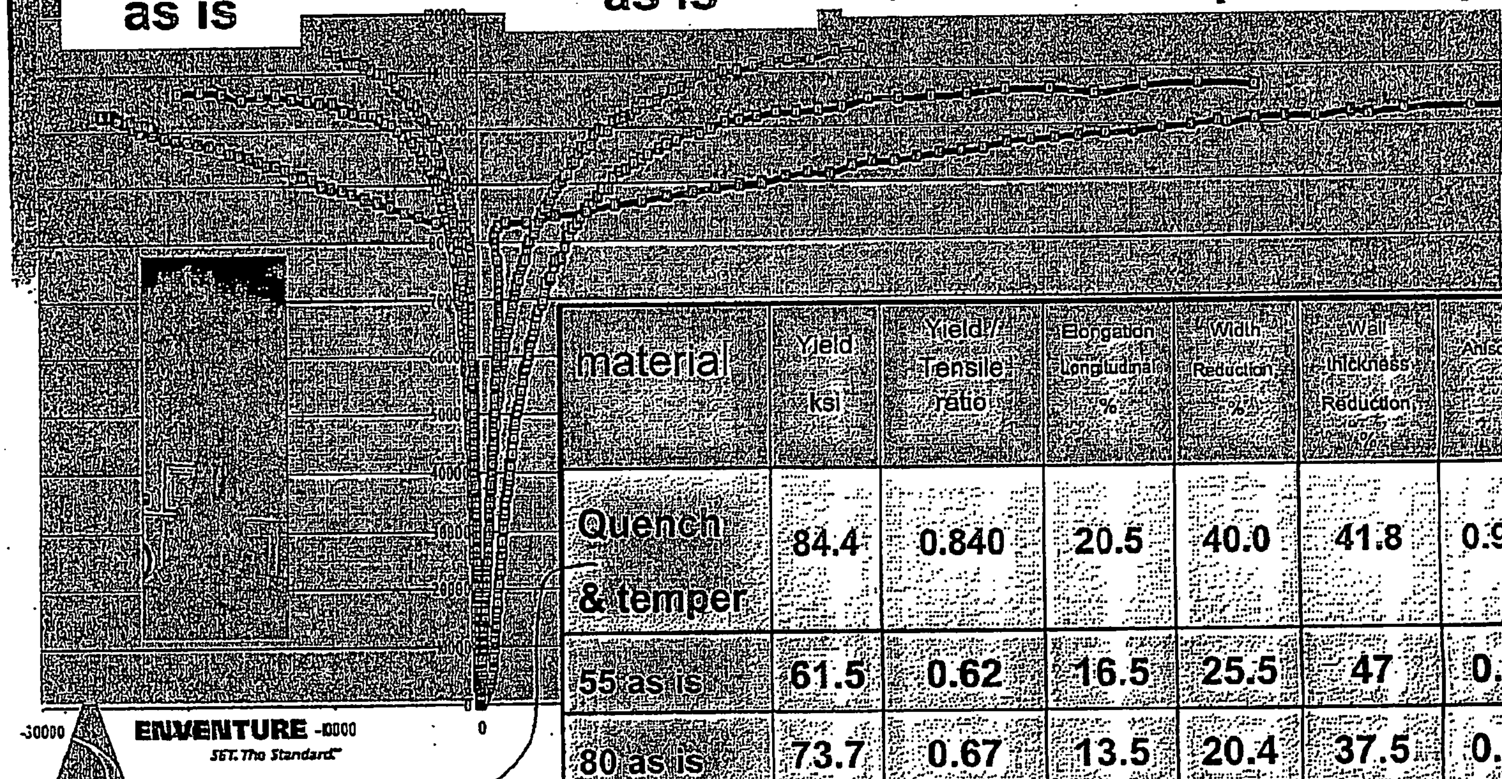
Engineering Stress vs. Strain Curve

(as received pipe vs. heat treated)

Pipe 7 " as is

Pipe 9 5/8 " as is

Quench & temper 9 5/8 'pipe

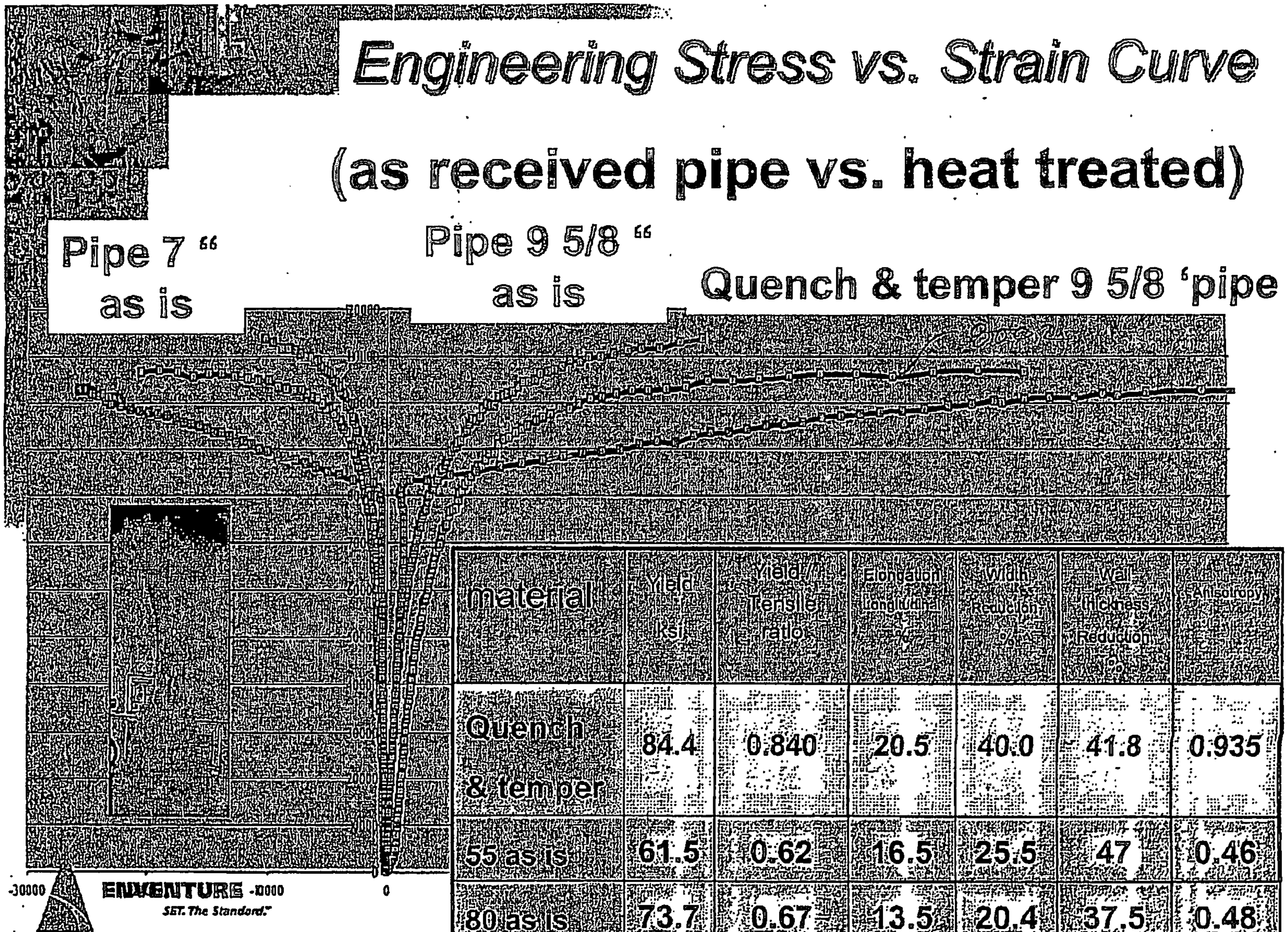


material	Yield ksi	Yield / Tensile ratio	Elongation Longitudinal %	Width Reduction %	Wall thickness Reduction %	Anisotropy
Quench & temper	84.4	0.840	20.5	40.0	41.8	0.935
55 as is	61.5	0.62	16.5	25.5	47	0.46
80 as is	73.7	0.67	13.5	20.4	37.5	0.48

FIGURE 80a

Engineering Stress vs. Strain Curve

(as received pipe vs. heat treated)



material	Yield ksi	Yield / Tensile ratio	Elongation Longitudinal %	Width Reduction %	Wall thickness Reduction %	Anisotropy
Quench & temper	84.4	0.840	20.5	40.0	41.8	0.935
55 as is	61.5	0.62	16.5	25.5	47	0.46
80 as is	73.7	0.67	13.5	20.4	37.5	0.48

FIGURE 80b

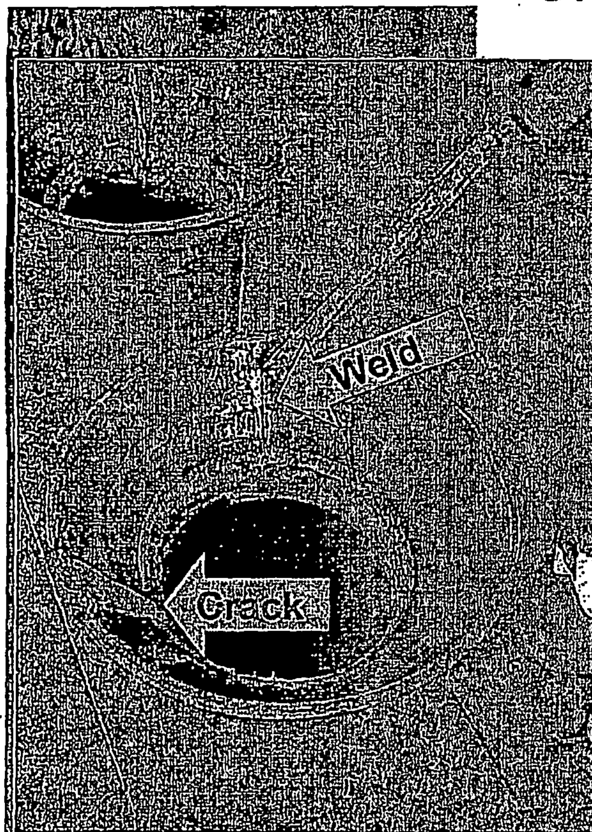
Bone Sample Formability Judgment

	Sample	Yield	Y/U	Elongation	Width reduction	Wall thickness reduction	Anisotropy	Technology
8100								
	40045	80.1	.72	35	35	33	.92	Hot stretch, reduced (1950°), rotary straightened
8102	4-100	89.7	.88	25	22	20	1.1	Normalized (1850°), cold drawn, annealed (1050°), rotary straightened
8104	5-790	88.1	.87	16	24	30	.76	Hot stretch, reduced (1950°), cold drawn, annealed, rotary straightened
8106	40513	47.7	.73	38	43	49	.83	Hot stretch, reduced (1850°), rotary straightened
8108	40514	45.5	.69	40	50	53	.93	Hot reduced (1850°), cold sized, rotary straightened
8110	40241	52.7	.85	49	49	46	1.1	Hot stretch, reduced (1850°), rotary straightened

ENVENTURE
SET. The Standard.

FIGURE 81

Absorbed Energy and Flare Expansion Testing



material	Absorbed energy^ Longitudinal	Transverse	Weld	Flare expansion %
target	80	60	60	45
Quench & temper 8200	125	59	176	42
Quench & temper 8202	145	59	174	52
As is, 55 grade	100	40	70	32*
As is, 80 grade	50	30	4	30*

Quench& temper pipe, failure of pipe @ expansion load of 800000 & 1,200000 Lbs
*As received pipe, cracking in weld area
^ Measured at -4° F (-20° C)

ENVENTURE
SET. The Standard.

FIGURE 82